BERMUDA.

REPORTS

OF THE

Board and Department of Agriculture

FOR THE YEAR

1923

IMPERIAL BUREAU OF MYCOLOGY
6 FEB. 1925

PRINTED BY
WATERLOW & SONS LIMITED,
LONDON, DUNSTABLE & WATFORD.

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Board of Agriculture, 1923.

Honble. S. S. SPURLING, O.B.E., M.C.P., St. Georges, *Chairman.*
Honble. J. P. HAND, M.B.E., M.C.P., Pembroke, *Vice-Chairman.*
E. F. ZUILL, Esq., M.C.P., Devonshire.
H. A. PENISTON, Esq., M.C.P., Smiths.
B. C. C. OUTERBRIDGE, Esq., M.C.P., Smiths.
W. A. H. BARNES, Esq., Southampton.
W. J. H. TROTT, Esq., Pembroke.
H. E. D. SMITH, Esq., St. Georges.
J. DEMOURA, Esq., Southampton.

Department of Agriculture, 1923.

Director of Agriculture—E. A. MCCALLAN.

Plant Pathologist—LAWRENCE OGILVIE, M.Sc., M.A., B.Sc. (from 27th September).

Inspector of Produce—G. E. WINTER.

Government Veterinary Officer—R. L. TUCKER, D.V.S. (Part-time Officer).

Second Agricultural Assistant—J. J. OUTERBRIDGE (to 9th October).

Clerk to Board and Director—G. L. YOUNG.

Assistant Inspector of Produce—E. L. ADAMS (Part-time Officer).

Sub-Inspectors of Produce—F. W. WILLIAMS and T. H. DOE (Part-time Officers).

Agricultural Station,

Bermuda,

10*th June*, 1924.

SIR,

I am directed by the Board of Agriculture to lay before His Excellency the Governor, for the information of the Legislature, the accompanying reports of the Board and Department of Agriculture for the year ended 31st December, 1923.

I have the honour to be,

Sir,

Your obedient servant,

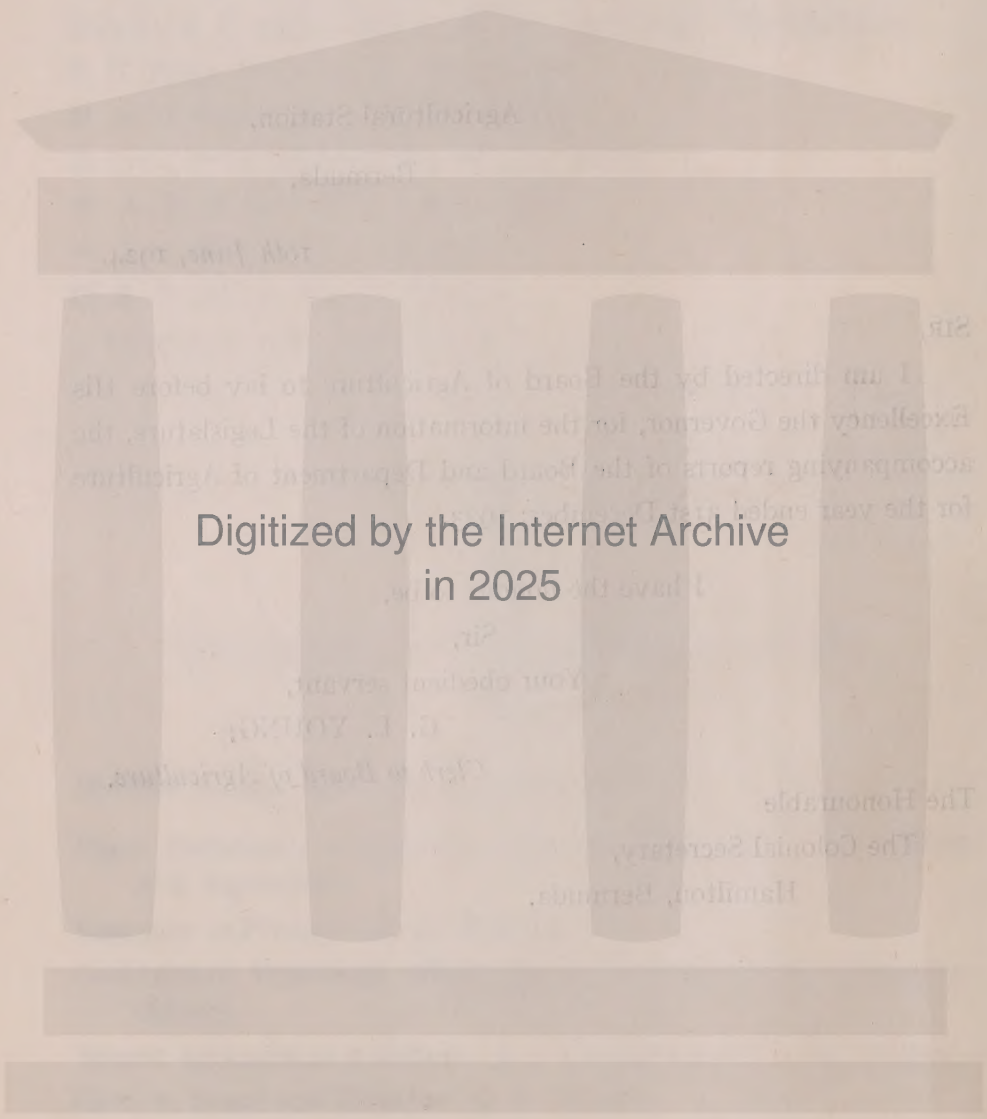
G. L. YOUNG,

Clerk to Board of Agriculture.

The Honourable

The Colonial Secretary,

Hamilton, Bermuda.



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Report of The Board of Agriculture For the Year 1923.

The year under review has not been prosperous financially for agriculture, but on the other hand, it has demonstrated that a reasonably decent living, a sound physical development and a sane outlook on life are attainable by application to farming in Bermuda.

The Board become more and more convinced that the ultimate success of farming in the Colony is in the further education of would-be farmers, in their boyhood, in the scientific as well as the practical side. Professor Whetzel expresses this very ably, and it is sincerely to be hoped that some active steps in this direction will soon be taken.

Bermudians of Portuguese extraction are developing into the Colony's farmers, almost to the exclusion of others, but there is a regrettable tendency on the part of the younger people to leave the land, and to seek other occupations where more excitement and pleasure are to be found. The importation of, largely, uneducated labourers to settle on the farms will not cure this evil, and only agricultural education emphasising the wonders, pleasures and advantages of a life on the land made possible by farming with modern implements and with scientific accuracy and knowledge, will successfully and finally solve the problem.

The Annual Agricultural Exhibition has again demonstrated the interest which the public takes in agriculture, and I wish to record the Board's appreciation of the organising ability of the Director shown in the really remarkable development which has taken place in the Exhibition within the past two years. Permanent buildings and well laid out grounds are necessary now to accommodate the public in a satisfactory way.

The wisdom of the decision of the Legislature in creating the office of Plant Pathologist is being amply proven by the work of Mr. Ogilvie, and the knowledge now available to farmers with respect to many previous puzzling diseases will be worth many times the expenditure incurred.

On behalf of the Board I wish to gratefully acknowledge the reductions in freight rates on vegetable products, and I take this opportunity of stressing the point that a regular service to New York with Saturday sailings and low freight rates must be secured for agriculture, even if it calls for an expenditure by the Colony in the form of a subsidy.

I view with much satisfaction the way the Farmers' Market is developing, and believe that the conditions regarding delivery costs and the like will very gradually, but surely, drive home to residents of Bermuda the necessity of using the Market for securing reasonably priced fresh agricultural products direct from the producers.

The work of the Department is set out in fairly complete detail in the attached reports, which bear witness to the energy and ability displayed in their work by all officers of the Department.

S. S. SPURLING,

Chairman, Board of Agriculture, 1923.

ST. GEORGES,

3rd June, 1924.

Report of the Director of Agriculture For the Year 1923.

The Chairman,

Board of Agriculture.

In accordance with the provisions of the Agricultural Department Act, 1921, I have the honour to submit my report for the year 1923. Other reports are also submitted.

ACTIVITIES OF THE DEPARTMENT.

The activities of the Department are varied, and during the year under report have included the maintenance of the Agricultural Station, experiments with crops and the growing of plants for distribution; inspection services in relation to agricultural and horticultural exports, imported seed potatoes, vegetable seeds, nursery stock, bananas and live stock, local infectious animal diseases and local plant diseases and pests; the improvement of potatoes and other crops, and live stock; investigation of local plant diseases and pests and methods of control; representation in the New York market, the publication of market information, and the establishment and supervision of a local Farmers' Market; the publication of the monthly Agricultural Bulletin and other matter; the organisation and direction of the Annual Agricultural Exhibition, and assistance to the Trade Development Board in connection with the Canadian National Exhibition; the supervision of Boys' and Girls' Agricultural Clubs; assistance to the Immigrant Labour Board in connection with the importation of farm labourers, and other matters pertaining to "the practice and study of agriculture."

AGRICULTURAL STATION.

An account of the principal work performed at the Station follows:

Potatoes.—Potatoes continue to receive the principal attention.

Triumphs.—Seven strains of Triumphs were tested during the season of 1922–1923, namely (*a*) from Messrs. Hickox-Rumsey Co., Inc., Batavia, New York; (*b*) from New Brunswick Brokers, Ltd., Fredericton, New Brunswick; (*c*) from Mr. Gus Forsling, Bushnell, Nebraska; (*d*) from Mr. J. W. Smith, Kent, Wisconsin; and (*e*) from the George W. P. Jerrard Co., Caribou, Maine. Part of the strain (*a*) had been grown at Batavia and part at Water Mill, Long Island, part of the strain (*b*) had been grown at Fredericton and part had been grown with the strains (*c*) and (*d*) at the Long Island Demonstration Farm for this Department by Director H. B. Fullerton, and strain (*e*) was representative of the seed planted generally in the Colony. It had been grown on Long Island for the Bermuda trade from seed which had been field inspected at Van Buren, Maine, by the Department.

Strains (*a*), (*b*), (*c*) and (*d*) showed greater freedom from leaf-roll and mosaic than (*e*) ; and the Long Island grown stock of (*b*) and (*a*), (*c*) and (*d*) gave larger yields, as the following table shows :

Strain.	Yield, pounds per rod.
(*a*) Hickox-Rumsey (Batavia)	75
(*e*) Jerrard	59
(*a*) Hickox-Rumsey (L. I.)	80
(*e*) Jerrard	50
(*a*) Hickox-Rumsey (Bat. and L. I.)	68½
(*e*) Jerrard	47½
(*b*) New Brunswick (L. I.)	79
(*c*) Forsling	76
(*d*) Smith	72½
(*e*) Jerrard	51

Strain (*b*) from Fredericton when planted in Bermuda in October, 1922, sprouted very slowly, and the yield obtained from it was much smaller than the yields from the other strains and from the same strain from Long Island.

On 1st May seed received from Messrs. Hickox-Rumsey Co., Inc., was planted, and the percentages of leaf-roll and mosaic were respectively 1·3 and 2·3. Stock from this seed was planted in October, 1923, and the second generation contained 4·5 per cent. leaf-roll ; mosaic was masked.

In October, 1923, the following strains were planted : (*a*) from Messrs. Hickox-Rumsey Co., Inc., and grown by them at Batavia and Water Mill, Long Island ; (*b*) from the same firm and grown by Messrs. Hy. Zimmer and Son at Mattituck, Long Island ; (*c*) from the New Brunswick Brokers, Ltd., and grown by them at Fredericton, New Brunswick ; (*d*) from Mr. Gus Forsling, Bushnell, Nebraska, and grown for the Department by Director H. B. Fullerton of the Long Island Railroad Demonstration Farm ; and (*e*) a strain discovered at Belmont, New York, by Mr. W. H. Allen.

The percentages of leaf-roll and mosaic recorded at the Station were as follows :

Strain.	Leaf-roll.	Mosaic.
(*a*) Hickox-Rumsey (grown by self)	12·3	2·9
(*b*) Hickox-Rumsey (grown by Zimmer) ...	21·9	5
(*c*) New Brunswick	2·3	78·5
(*d*) Forsling	8	5
(*e*) Belmont	0·25	8

Again the seed (*c*) from Fredericton was very slow in sprouting, and was heavily infested with mosaic. The Forsling strain (*d*) did not give the results expected of it. The Belmont strain (*e*) proved itself the best of the five. The very disappointing behaviour of strains (*a*) and (*b*) is treated fully under " Potatoes."

Garnets.—Thirteen strains of Garnets from Clifton, Masstown, St. Croix and Cornwallis, Nova Scotia, were under test, chiefly with respect to leaf-roll infestation. The behaviour of the seed was in marked contrast to that of last year. Seven strains were free from leaf-roll, the highest percentage of infestation was 7·3 and the average 1·9. The crop was reduced by drought.

KIDNEY VARIETIES.—The following varieties of white kidney potatoes were grown from English seed and shipped to London: Dargel Early, Eclipse, May Queen, Midlothian Early and Sharp's Express. They were found to be susceptible to both late and early blight, **Phytophthora infestans** and **Alternaria solani,** but frequent dusting with copper-lime kept the diseases in check. High winds reduced the crop. The subject is further treated elsewhere.

IRISH COBBLERS.—This variety was planted at the Station for the first time in the spring of the year under report. It appears to be a good cropper under local spring conditions, is superior to the Garnet for table use, and is deserving of the attention now being given to it by Bermuda farmers.

SULPHUR TREATMENT FOR SCAB.—Prof. H. H. Whetzel of the New York College of Agriculture when associated with this Department obtained from the Texas Gulf Sulphur Company, New York, a quantity of sulphur for soil treatment to control common scab (**Actinomyces chromogenus**). Application was made at the rate of 600 pounds per acre at the Station and on badly infested fields on a number of farms. Favourable results followed, but the test cannot be considered conclusive. The Department is under obligation to the Company for the material for the experiment.

NITRATE OF SODA TREATMENT FOR HASTENING SPROUTING.—The Department is indebted to Prof. T. J. Rosa of the California College of Agriculture for information regarding the soaking of cut potato seed in nitrate of soda solution to stimulate sprouting. The treated potatoes sprouted more quickly and made more rapid growth after sprouting. The practice may prove to be of value with early planted Triumphs.

Experiments with fertilisers, different sized cuts and other cultural methods were conducted with potatoes.

Onion Experiments.—Comparative tests were made, with respect to freedom from red-skinned and other undesirable types of bulbs, of seed obtained from Mr. J. P. Cambuley, Mr. T. M. Reid and Messrs. Wildpret Bros., Teneriffe, Messrs. Robert Tucker and Co., London, and Messrs. Aggeler and Musser, California. All strains except the first-named were fairly free from undesirable bulbs. That from Messrs. Robert Tucker and Co. contained the second highest percentage, but this firm's seed has greatly improved in this respect. The seed from the remaining firms was quite satisfactory in respect to freedom from red-skinned and other objectionable bulbs.

An experiment of soil treatment with formalin in conjunction with frequent light dressings of nitrate of soda to control pink-root (**Fusarium malli**) was undertaken, but ultimate results were negatived by a serious outbreak of blight (**Peronospora Schleideni**). Favourable results were being secured. The crop was seeded on 27th October, 1922, and blight appeared about 22nd March, 1923. On the week previous it had been noted that on the parts of the beds treated with formalin the tops were larger and of a darker green. The roots of the plants that had received three applications of nitrate

of soda ($\frac{3}{4}$ lb. per rod at each application) were quite long and few dead roots were to be seen, the roots were proportionately less healthy on the plots that had received two applications and one application respectively, and on the plots that had received no nitrate numerous dead roots were observed.

When the blight was recognised the plots were dusted with copper-lime, but the treatment was not sufficiently early to save the crop.

Vegetable Experiments.—Cultural and varietal experiments were conducted with a large number of vegetables.

Beet.—Having regard to the requirements of the New York market, it appears that a reliable strain of the Early Flat Egyptian is more suitable than the Crosby's Egyptian. It has been found difficult to secure a strain that gives satisfaction over a number of seasons, and much of the experimental work with beets is for the purpose of selecting a strain that is constant in behaviour.

Carrot.—Only the two varieties approved by Regulations were tested, Chantenay and Danvers, and the former scored higher in every case but one. It has a medium top, more or less rounded end, and is of good colour.

Cauliflower.—Two varieties were grown, and Aggeler and Musser's Snowball gave very satisfactory results. As a rule the small early varieties of cauliflower are best suited to local conditions.

Celeriac or Turnip-Rooted Celery.—This vegetable has been twice experimented with on high land where the roots have failed to reach marketable size. On low land unsuited to celery it may be found to thrive.

Endive.—Several strains of two types were tested, Broad-leaved Batavian or Escarole and Green Curled or Chicoree. Cultivation is similar to lettuce, and there is a local demand for this vegetable. Of the two, Green Curled is more readily destroyed by drop-wilt (**Sclerotinia libertiana**). Rotation should be followed.

Kohl rabi.—Early White Vienna and similar varieties should be more freely planted. When gathered young the vegetable is superior to turnip, but it must be grown rapidly and reaped while still young and tender. There is some demand for kohl rabi in the New York market.

Soy Bean.—This summer vegetable is deserving of general cultivation. As a green shelled bean it is of delicious flavour and is an excellent keeper when dried. It should be planted in May and early June.

Co-operative Celery Tests.—Three strains of French-grown and one of American-grown celery were distributed among ten growers. The reports were confusing in some particulars, but the information obtained was of value.

Fodder Crops.—A number of varieties of fodder corns and other crops were planted. Teosinte gave excellent results.

Roselle.—A new plant, roselle (**Hibiscus Sabdariffa**) was grown during the summer. It withstood the drought and heat and should prove a useful plant, for the calyxes and surrounding bracts make a good preserve.

Test of Marsh Soils.—Soils from Fairyland and Mill Creek were tested to ascertain their suitability for cropping, and it appears from the tests made that these soils are of considerable agricultural value and should be fit for cropping within six months after removal from the Creeks.

Green Manuring.—All the potato plots and many of the vegetable plots were sown to cowpeas in June for green manuring. The practice of leguminous green manuring is but little followed in Bermuda, yet this method of adding atmospheric nitrogen to the soil should commend itself to every farmer.

Fruit.—An irregular crop of citrus matured; two grapefruit trees bore nearly two hundred fruit each, and many other trees, particularly oranges, bore none. Loquats and sapodillas fruited heavily. Figs and persimmons fruited, and a few mangoes matured. Mr. D. C. Gillett of the Buckeye Nurseries, Florida, has very generously offered to give the Station a collection of citrus trees. All the orchards should be fenced.

Flower Beds, Lawns and Greenhouses.—The flower beds and lawns have been maintained in good order, but lack of gardeners deprived the greenhouses of proper care during the latter half of the year. Many minor improvements have been effected. The work at the north entrance, begun in 1922, has been completed, and as the plants become established the beauty of the entrance will be greatly enhanced. Some work has been done on the newer portion of the grounds (Montrose), but very much more remains to be done. Chief among the plants grown for distribution were 1,000 whistling pines (**Casuarina equisetifolia**) from local seed. The Department is indebted to Dr. L. H. Bailey for identifying plants, and to His Excellency the Governor, Sir J. J. Asser, New York Botanical Garden, W. R. Mustoe, Esq., Superintendent, Horticultural Division, Delhi, and many other friends for donations of seeds.

Live Stock.—Montrose Sovereign, a Guernsey male, calved at the Station, 6th January, 1922, has grown into a large rugged animal, and is standing for service at the Station. Montrose Pioneer, another Guernsey male, calved 25th January, 1923, was sold to Mr. W. A. Barnes, Southampton. The Ayrshire bull, Pinebluff Laddie, was brought to the Station from the farm of James Morgan, Esq.,

in April, and has since stood for service here. The Ayrshire bull, Hillside Spicey's Laddie, and the Guernsey bull, Albamont Adonis, being no longer fit for service, were sold to the butcher. Mr. J. C. Haartz, Boston, Mass., from whom Albamont Adonis was purchased in 1921, very generously replaced the animal with two others, Albamont Titan (calved 21st September, 1921) and Albamont Argonaut (calved 31st December, 1922). The first-named bull was placed on the farm of Mr. B. C. C. Outerbridge, M.C.P., Smiths, and the other is held at the Station. Both animals have grown well since their arrival here. The two cows, Dora of Atwood's Dairy, and Albamont Juliet, purchased with Albamont Adonis in 1921, were both in calf at the close of the year under report. Their milk production has been as follows: Dora, 3,640 lbs. (309 days), and Juliet, 7,935 lbs. (365 days).

Disposal of Milk and Vegetables.—During the year 2,586 quarts of milk were given to the Hospital, three quarts daily were issued to the Director, and the remainder fed to the young stock. Vegetables, including 44 barrels potatoes, were given to the Hospital, Hamilton Gaol and the Lunatic Asylum. Vegetables and plants were given to charitable bazaars. Some produce was shipped. Under "Reimbursements" will be found the value of the produce sold and otherwise disposed of.

Visitors.—The number of visitors to the station is increasing. His Excellency the Governor is a frequent visitor. Among the other prominent visitors during the year were Dr. Andrew Balfour, Hon. H. H. Hutchings, Commissioner of Cayman Islands, Director H. B. Fullerton of the Long Island Railroad Demonstration Farm, Mr. D. C. Gillett, President of the Buckeye Nurseries, Florida, Mr. Burnett Landreth, President of Landreth's Seeds, Mr. H. T. Edwards, of the Bureau of Plant Industry, United States Department of Agriculture, and Mr. W. P. Kent, American Consul.

Office Work.—During the year 1,448 letters were dispatched and 1,075 received. A large number of circular letters, market quotation post-cards, inspection certificates, and press articles were sent out. The clerical and accounting work of the Annual Agricultural Exhibition was performed in the office with little outside assistance. An important work completed during the year under report was the card indexing of all bulletins dealing with plant diseases and pests and control measures. The same task remains to be done with respect to the bulletins dealing with other subjects. The office staff consists of one clerk, who is also clerk to the Board. The office hours are from 8.30 a.m. to 5 p.m. A larger staff is required.

The growth of the office work during the past five years is indicated by the following table:

Year.	Letters dispatched.	Letters received.
1919	663	457
1920	533	310
1921	1,054	635
1922	1,308	858
1923	1,448	1,075

AGRICULTURAL YEAR OF 1923.

The year 1923 was not a prosperous one for Bermuda agriculture. Exports of agricultural products were below the average for the previous ten years. Reduced acreage was to some extent responsible for reduced production, but there were other important contributing factors ; for the Triumph potato crop was severely injured by high winds, and the Garnet crop was no less hurt by drought, but the greatest loss was in onions, which were destroyed by blight (**Peronospora Schleideni**). Compared with the previous ten years' averages (represented by 100) the quantities shipped were as follows : potatoes, 56 ; onions, 32 ; other vegetables, 102 ; lily bulbs, 278. Production for local consumption increased during the year. Generally speaking, selling prices were not considered sufficiently high to offset the high cost of production and reduced yields. A comparison of costs and prices for the years 1913 and 1923 will be found in Appendix A.

POTATOES.

The exports of potatoes during the last ten years have been as follows :

1914	... ...	41,532 barrels.
1915	... ...	51,519 ,,
1916	... ...	55,166 ,,
1917	... ...	74,578 ,,
1918	... ...	69,453 ,,
1919	... ...	91,777 ,,
1920	... ...	54,031 ,,
1921	... ...	58,955 ,,
1922	... ...	43,651 ,,
1923	... ...	33,604 ,,

The quantity shipped during the year under report was the smallest annual shipment since 1908. As previously stated, the fall crop of Triumphs was severely injured by wind and the winter crop of Garnets no less injured by drought. New York prices being low at the time the latter crop was dug a considerable quantity was retained for domestic consumption. Domestic potato prices encouraged the growing of a small quantity of Irish Cobblers. The increased tourist trade is increasing the domestic consumption of Bermuda potatoes.

The improvement of seed potatoes continues to occupy the attention of the Department, but not always do the results appear to be commensurate with the effort.

Since the Garnet seed disaster of 1922 that variety has shown marked improvement. The Nova Scotia growers, acting on the advice and instruction of the Dominion Inspector, Mr. W. K. McCulloch, are selecting their seed with much greater care, and are thoroughly rogueing it. The results are most encouraging. The Province was visited last summer by Mr. J. J. Outerbridge of the Department, and his report on the field inspection is attached. If the growers continue to exercise the care shown during the past year, the quality of the seed should be maintained and possibly improved.

The behaviour of the Triumph seed planted in Bermuda in the fall of the year under report was worse than that of the Garnets in the previous year, and it is considered advisable to devote some space to the subject.

Maine-grown seed was available for planting in Long Island, for the Director visited Aroostook in the summer of 1922, and inspected and approved of the best fields available. The selected stock consisted of one small field near Frenchville with 15 per cent. mosaic infestation, and large fields near Van Buren containing from 30 per cent. to 40 per cent. The situation with respect to seed from Maine was unchanged in 1922, but the Long Island contractors were advised to also plant other seed in view of the increased yields secured in Bermuda in 1922 from seed from other localities. Arrangements had been made by the Director whereby certified seed could have been obtained from Nebraska and Wisconsin. The Director was in New York in January, and was then given to understand that only one firm of the former contractors, Messrs. Hy. Zimmer and Son, proposed to plant, and they planned to purchase seed in Maine and make experimental plantings of western-grown seed.

Messrs. Hickox-Rumsey Co., Inc., of Batavia, New York, had been persuaded by Prof. H. H. Whetzel to experiment with Triumph seed for Bermuda, and so good had been the results obtained from their seed when planted here in the fall of 1922 that it was with considerable satisfaction that it was learned that the firm proposed to plant twelve acres at Water Mill, Long Island. In March the Director was informed by cable that the firm had surplus seed to dispose of, and Messrs. Henry Zimmer and Son were advised to plant some of this stock, even were it necessary to reduce the quantity of Maine-grown seed to be planted by them. In June the Director went to Long Island to field inspect the potatoes planted for sale in Bermuda. It was then ascertained that Messrs. Henry Zimmer and Son had planted seed obtained from Batavia only. No Maine seed had been planted. At the time this was considered to be a matter for congratulation, for though scarcely sufficient seed was available, it appeared to be of the best. In vigour of vine, perfection of stand and freedom from leaf-roll and mosaic, the fields inspected were superior to any fields of Triumphs seen in Long Island in recent years, both Hickox-Rumsey's and Zimmer's appeared alike good. The readings of leaf-roll and mosaic were less than 1 per cent. and 1·1 per cent. respectively.

The behaviour of this seed in Bermuda was contrary to all expectation of it. So high was the percentage of leaf-roll that Messrs. Hickox-Rumsey were advised to send down a pathologist to inspect it, and Mr. K. H. Fernow of the New York State College of Agriculture came down at the firm's expense. Abstracts from his report are attached.

Before attempting to explain the behaviour of the seed it may be well to refer to the past behaviour of this variety in Bermuda, for it has been stated that the yields from this importation were

very much lower than the yields from Triumphs imported previous to the Department's attempts to "improve" the variety. The following figures collected by Mr. E. J. Wortley, former Director of Agriculture, and to be found in his report for the years 1914 and 1915, page 24, do not support this view.

BLISS TRIUMPHS.

	Barrels planted.	Barrels reaped. Marketable.
1. R. J. Johnson	25	19
2. B. C. C. Outerbridge	6	10
3. E. R. Outerbridge	37	110
4. S. Ingham	1	1
5. M. C. Benevides	4	6
6. Joe Simons	4	5
7. J. De Silva	3	2
8. A. Semoa	8	13
9. M. Carreira	100	300
10. A. Doe	30	30

To return to the disaster of the season 1923–1924, the average percentages counted by Mr. Fernow are given below :

(*a*) Fields planted at Batavia by Hickox-Rumsey ... ... 11·4

(*b*) Ten-acre field planted at Water Mill, Long Island, by Hickox-Rumsey ... ... 15·0

(*c*) Two-acre field planted at Water Mill, Long Island, by Hickox-Rumsey ... ... 22·4

(*d*) Sixteen three-quarter-acre fields (average) planted at Mattituck, Long Island, by Zimmer ... ... 41·2

As there is reason to believe that the seed planted by the one firm in Batavia, and by both on Long Island was from the same source, it appears reasonable to assume that the increases of leaf-roll which appeared in the Long Island-grown seed when planted in Bermuda, 3·6, 11·4 and 29·8 respectively, were due in part to unfavourable conditions in Long Island. These conditions may have included (1) higher temperature, (2) small fields, and (3) neglect to rogue out diseased plants. With respect to condition (1) it is generally admitted that a high temperature favours the spread of the disease. Quanjer states, one is inclined to believe that a hot and dry climate favours the deterioration, and Cotton says that the disease spreads but little in the north. It will be noted that regarding condition (2), the infestations in Bermuda were in reverse ratio to the size of the Long Island fields. This points to outside infestation. With respect to (3) it is known that Hickox-Rumsey Co. rogued their fields and that Zimmer did not. It is relatively easy to attempt to account for the differences in the percentages of leaf-roll infestation from the Long Island lots, but to account for the high percentages in all is more difficult. Though the seed furnished by Messrs. Hickox-Rumsey was considered to be superior to the seed obtainable from Maine, it had been grown in New York State, and it may be established in the future that seed for Long Island—Bermuda planting

should be grown far north. Schultz and Folsom state that environment influences both the symptoms and the rate of spread of degeneration diseases, and they have obtained evidence that the spread of disease is more rapid in the south than in the north. If the reason of the rapid spread of leaf-roll in Bermuda was due to unfavourable environmental conditions in Long Island and Batavia in previous generations, it remains difficult to explain why the symptoms of leaf-roll were so completely masked in Long Island, and why there was so great difference between the behaviour of Batavia—Long Island stock when grown in Bermuda in the two seasons of 1922–1923 and 1923–1924. Possibly the difference in behaviour may have been due to some extent to seasonable conditions which caused an absence of aphids or other carrying agents in the first year. It is difficult to fix the causes, probably there were many, the chief of which may have been that the seed for Long Island was not grown sufficiently far north, and that the conditions on the Island were highly favourable to the increase of aphids and other spreading agents.

If Bermuda's Triumph seed is to be grown on Long Island, and no better locality has yet been found, the following safeguards should be adopted :

(1) The seed for Long Island should be obtained from a suitable source. Possibly no better locality exists than north-eastern Maine, provided clean seed and proper isolation can be secured.

(2) The fields in Long Island should be reasonably large (6 to 10 acres) and well isolated.

(3) Early and frequent rogueing should be followed.

(4) Inspection should be more frequent than in the past.

In considering the improvement of the Triumph potato, it should be recognised that this variety is lacking in vigour and is highly susceptible to infection of mosaic, and (under some conditions) of leaf-roll. Did the Colony plant white-skinned potatoes the task of the Department in securing disease-free seed would be comparatively easy.

ONIONS.

Exports of onions for the last ten years have been as follows :

1914	87,477	crates.
1915	153,030	,,
1916	148,221	,,
1917	132,358	,,
1918	133,141	,,
1919	131,271	,,
1920	109,072	,,
1921	49,464	,,
1922	70,874	,,
1923	35,176	,,

The crop was the smallest reaped for very many years ; this was due to some extent to reduced acreage, but chiefly to the very severe outbreak of blight (**Peronospora Schleideni**). So long a time had elapsed, about thirty years, since the last severe appearance of this disease that it was not quickly recognised and control measures were not taken in hand until too late. It is estimated that the crop was reduced by 75 per cent.

As previously stated in this report, the seed now received from Teneriffe is producing bulbs that are practically free from red-skinned and other admixtures. In this respect great improvement has been effected since the visit to Teneriffe of the former Director, Mr. E. J. Wortley, in 1920. Earliness of maturity is highly desirable in Bermuda-grown onions, and it is debatable if the present-day lateness of the onion crop is more largely due to seed or pink-root. Certain it is that more attention should be paid to the control of pink-root (**Fusarium malli**), and the methods of control are simple. The subject of the character of the seed is being reopened by the Board, and some satisfactory results may be secured.

GREEN VEGETABLES.

Exports of green vegetables for the last ten years have been as follows :

1914	... ...	167,896 bushel crates.
1915	... ...	194,665 ,, ,,
1916	... ...	252,333 ,, ,,
1917	... ...	209,894 ,, ,,
1918	... ...	63,976 ,, ,,
1919	... ...	162,517 ,, ,,
1920	... ...	260,784 ,, ,,
1921	... ...	263,649 ,, ,,
1922	... ...	191,806 ,, ,,
1923	... ...	194,435 ,, ,,

The exports of the year were in advance of those of the previous year. Fava beans, beets, celery, lettuce, kale and turnips showed an increase, and carrots and parsley a decrease. Small quantities of kohl rabi and extremely small quantities of string beans and peas were shipped. For the first time tomatoes were shipped to Canada in quantity.

The local vegetable trade is increasing, and is capable of much greater development. The Farmers' Market is assisting in this development.

THE FARMERS' MARKET.

After years of talk the Farmers' Market came into being very quietly on Wednesday, 3rd January, 1923, when seven farmers and eighty-seven purchasers met to buy and sell without the services of middlemen. A space near the Hotel Point Pleasant, Hamilton, was set apart for the purpose by the Corporation of Hamilton. At the end of February the market place was moved to the upper floor of No. 6 Shed, a place not so well located, but in all other respects better suited to the purpose than the other.

His Excellency the Governor, Sir J. J. Asser, is keenly interested in the development of the Market, and at the Annual Agricultural Exhibition offered a handsome cup for the best collection of vegetables grown and exhibited by a farmer who had sold in the market. Mr. E. W. Doe, Paget, was the winner. The Mayor and Corporation of Hamilton have been very generous in their attitude toward the Market, and the Department is under obligation to them.

The Department has aimed to keep the Market and the advantages of direct buying constantly before the public by means of circular letters, and articles in the local papers and the Bulletin. An attractive calendar advertising the Market was issued in January.

Though the Market has not been patronised by farmers and housewives to the extent that it deserves, it is serving a very useful purpose in the community, and is likely to grow far beyond its present proportions.

BERMUDA EASTER LILIES.

Exports of Bermuda Easter lilies for the past ten years have been as follows, according to the returns of the Revenue Department :

1914	... ...	941 cases.
1915	... ...	881 ,,
1916	... ...	1,224 ,,
1917	... ...	1,009 ,,
1918	... ...	823 ,,
1919	... ...	664 ,,
1920	... ...	749 ,,
1921	... ...	936 ,,
1922	... ...	1,604 ,,
1923	... ...	3,116 ,,

The quality of the bulbs continues to improve. This improvement is being brought about by increased care in selection on the part of some growers and the scrapping of their poorer bulbs by others. The poorest bulbs gravitate to the poorest growers, and in their hands rapidly degenerate and disappear. More rigid Government inspection at the packing sheds is also assisting in the improvement, and some packers are showing commendable interest in the exclusion of inferior bulbs. Further improvement is called for with respect to the separation of the types of bulbs.

CONTROL OF PLANT DISEASES AND PESTS.

Between the termination of Prof. H. H. Whetzel's association with the Department and the appointment of Mr. Lawrence Ogilvie as Plant Pathologist there was a hiatus of nearly eighteen months. During this period the Director undertook to direct the control of plant diseases and pests. Seasonable information was published monthly in the Agricultural Bulletin, and irregularly in the local newspapers, and at the Station and on their farms farmers were instructed regarding the control of the principal enemies of cultivated plants.

Prof. Whetzel retains his interest in the agricultural development of Bermuda. In January, 1923, he accompanied the Director to Washington to interview heads of Bureaus of the United States Department of Agriculture relative chiefly to matters affecting Bermuda's agricultural exports to the United States. In April he accepted the Board's invitation to be present at the Annual Agricultural Exhibition, and again prepared an interesting booth and gave instruction in the control of plant diseases and pests. His special report presented at the time is attached.

Dusting.—Dusting is superceding spraying as a control measure, but is not giving complete satisfaction, especially in respect to the control of blight (**Phytophthora infestans**) in potatoes. The fault is with the hand dusters in use, and a better make is needed. Because of the relative ease with which dust can be applied, farmers are likely to adopt this method of control more generally than ever spraying was practised. The cost of the dust is considered high by many, and a further hindrance is the lack of a regular supply. Importers are sometimes " out of " dust when it is most needed.

Oleander Scale.—The active spraying campaign against the oleander scale (**Aulacaspis pentagona**) ended with the year 1922. Since then the Department has furnished pumps, lime-sulphur and operator to property owners who make application and are willing to provide horse and man labour. Moderate use has been made of the pumps under these conditions. One pump without an operator in attendance was loaned to the Bermuda Development Company for use at Tuckers Town. The second pump was operated seventy-six days by the Department's mechanic, and spraying was carried out on about twenty properties. Satisfactory results were obtained from applications of soluble sulphur compound made at the close of 1922.

A second lot of parasitised mulberry twigs was received from Prof. F. Silvestri of R. Laboratorio di Entomologia Agraria, Portici, Italy, early in April, and distributed. It appears that **Aphelinus disspidis** is becoming better established here than are other natural enemies of **Aulacaspis** imported from Italy. In material sent to Prof. O. A. Johannsen of Cornell University **Aphelinus** was the only parasite found.

That **Aulacaspis** had been introduced into Bermuda on importations of plants from the West Indies was indicated by the finding of the pest on an importation of aralias from the West Indies and inspected by the Department in May, and was again found in November on another importation.

Palmetto Scale.—A few outbreaks of palmetto scale (**Comstockiella sabalis**) have occurred within the town of St. Georges, but the pest has not spread beyond the town, so far as the Department has ascertained.

Banana Quarantine.—On 14th February the Board provisionally removed the embargo on banana fruit which had been in operation since 19th September, 1921. Further study of the subject

made subsequently by the Plant Pathologist has confirmed the opinion then held, namely, that there is little, if any, danger of introducing Panama wilt (**Fusarium cubense**) to the injury of the Canary banana (**M. Cavendishii**) cultivated in Bermuda.

Mediterranean Fruit Fly.—In interviews with Dr. C. L. Marlatt and Dr. W. A. Orton, Chairman and Vice-Chairman respectively of the Federal Horticultural Board, it was made very clear to the Director that the presence here, even if in greatly reduced numbers, of the Mediterranean fruit fly (**Ceratitis capitata**) may become a grave menace to the Colony's export trade with the United States in vegetables and other agricultural products. Investigation of the control of this pest has been made a major project by the Plant Pathologist.

Snapdragon Rust.—Reference was made in Prof. Whetzel's special report to snapdragon rust (**Puccinia Antirrhini**) and a control programme was submitted. It was thought inadvisable by the Director to prohibit the growing of antirrhinum plants from imported seed, because the staff was not available to carry out the necessary surveys to prevent disregard of the ruling, but frequent appeals were made to flower lovers to (1) destroy all antirrhinums at the end of the flowering period, (2) to destroy all volunteer seedlings, and (3) to refrain from importing seedlings. A regulation was made prohibiting the importation of seedlings.

In October seedlings grown from imported seed were transplanted in a bed at the Station in which antirrhinums had not been grown for two years.

Regulations.—Minor amendments of the Regulations dealing with the control of plant diseases and pests were made during the year under report.

Acknowledgment.—Any reference to the control of plant diseases and pests would be incomplete without acknowledging the indebtedness of the Department to Rev. F. M. Brunton of St. Georges and Mrs. T. St. G. Gilbert and others of Somerset for their untiring zeal in combating the oleander scale.

The subject of plant disease and pest control is very ably treated in the report of the Plant Pathologist for the period 27th September to 31st December, 1923.

INSPECTION SERVICES.

Produce.—The report of the Inspector of Produce is attached. It deals fully with the service, and a perusal of it will disclose the nature of the work performed. During the absence of the Inspector, Mr. G. E. Winter, the inspection at the dock was in the charge of Mr. E. L. Adams, Assistant Inspector. Regulations requiring the use of standard celery and kale crates came into effect in 1923, and the shipment of celery in particular in crates of uniform capacity

has benefited the growers. The irregular size of the so-called bushel crate has been under discussion, but no action has been taken.

Seed Potatoes.—Triumph seed potatoes on Long Island were inspected by the Director. The Second Assistant, Mr. J. J. Outerbridge, inspected Triumphs in New Brunswick and Garnets in Nova Scotia. His report is attached. Seed potatoes are subject to a further inspection at the dock in Hamilton. This duty was performed by the Inspector of Produce whose report is attached.

Easter Lily Bulbs.—All bulbs of the Bermuda Easter lily exported from these Islands were inspected and certified. The inspection was performed by the Inspector of Produce.

Nursery Stock.—Imported nursery stock was inspected chiefly by the Director and the Second Assistant previous to the appointment and arrival of the Plant Pathologist in September, when that officer assumed this duty which calls for frequent visits to the Hamilton Post Office and dock. On the repeal of the banana quarantine the fruit was made subject to inspection on landing.

Control of Plant Diseases and Pests.—Many surveys were made in connection with the control of oleander scale (**Aulacaspis pentagona**) and palmetto scale (**Comstockiella sabalis**).

Vegetable Seeds.—Regulations governing the sale of vegetable seeds made on the 28th November, 1922, came into operation on 1st July, 1923. The Regulations provide for the registration of vendors of seeds, and fifteen firms registered. The object of the Regulations is to improve the character of vegetable seeds sold in the Colony, and every vendor is required to send to the Station samples to be tested for viability and suitability with respect, chiefly, to the New York market. A very large number of samples were received for the test, and the work required by the Regulations is very exacting and absorbs much time. As a rule the seeds prove satisfactory under test.

Infectious Animal Diseases.—All imported live stock is subject to inspection by the Government Veterinary Officer, Dr. R. L. Tucker, whose duties also include the control of infectious animal diseases. Dr. Tucker, whose report is attached, is able to report freedom from serious infectious disease during the year under report. As a further precaution against the introduction of disease, the Veterinary Officer has recommended the erection of a detention stable. Amendment of the Regulations dealing with this service has been made with respect to the slaughter of cattle infected with tuberculosis, certification regarding contagious abortion and other matters. The Board has considered the inhumane conditions under which live poultry is sometimes imported, but no action has been taken. Printed forms for use in connection with this service have been adopted.

MARKETING NOTES.

Representation in New York.—The Inspector of Produce, Mr. G. E. Winter, was in New York from 10th February to 9th June and from 16th to 23rd June. During these periods the Inspector kept the Department informed regarding market conditions by means of frequent cables and letters. The information thus received was made public through the local press, by notices posted at the dock, by postcards and by telephone. This service should be of great value to the farming community.

In addition to the service mentioned above, the Inspector by his presence in New York was in position to inform the Department of the condition of vegetables generally on discharge and of any special lot, and opportunity was given to correct faults in packing and the like ; he was able to direct the attention of the steamship company to matters of handling which required improvement or adjustment, and undoubtedly exercised a salutary influence on the prices obtained for Bermuda produce.

In connection with the Inspector's duties in New York, the opportunity is here taken to express the Department's appreciation of the courtesies extended to him by the officials of the Furness Bermuda Line.

Improvement of Vegetables, Packing and Containers.—The further improvement of the quality of vegetables, methods of packing and containers is given constant attention. Advancements effected during 1923 have already been mentioned, namely, registration of seedsmen, the adoption of standard celery and kale crates and a minimum number of bunched vegetables per crate.

Freight Rates to New York.—In January the Director proceeded to New York on the instructions of the Board to interview the principals of the Furness Bermuda Line regarding reductions in freights on agricultural produce. Capt. F. C. Misick, Clerk to the Trade Development Board, was associated with the Director, and the Department is indebted to him for his close co-operation. The requests of the Bermuda committee were met by Mr. H. C. Blackiston and Mr. A. J. Outerbridge in a generous spirit, and substantial reductions were granted. The following table shows the rates in force on agricultural products and supplies in 1913 and 1923 :

UPWARD FREIGHTS.

	1913.	1923.
Potatoes, per barrel	50 cents.	80 cents.
Onions, per crate	14 ,,	20 ,,
Celery, per standard crate (2 bu.), in chill-room	60 ,,	65 ,,
Top crops, per crate, in chill-room	30 ,,	25 ,,
Root crops, per crate, in chill-room	25 ,,	25 ,,

DOWNWARD FREIGHTS.

Seed potatoes, per barrel	50 ,,	80 cents.
Fertilisers, per 100 lbs.	15 ,,	30 ,,
Empty barrels, each	15 ,,	25 & 35 cents.
Box shucks, per cubic ft.	8 ,,	15 cents.

Shipping facilities, including chill-room accommodation, was adequate for the agricultural requirements of the year, except in June, when a change in the schedule caused an estimated loss to celery growers of $24,000.

New Containers and Methods of Sale.—Two new containers were tested, but both proved unsuitable. A trial was made of direct sale of potatoes, but the results were not encouraging.

Trade Mark.—The adoption of a distinctive mark for Bermuda produce has been under consideration for many years, and in 1923 five pounds was offered for the best design. A number were submitted, but none were accepted. In the end the Wales Advertising Company of New York prepared an excellent design, but the use of it has been postponed until improvements are made in the crates. Enquiries are being made regarding an advertising tape for tying bunched vegetables.

The Canadian Market.—"To encourage the export of Bermuda agricultural produce to the Dominion of Canada" the Shipment of Produce to Canada Act was passed by the Legislature in 1923. Under the provisions of the Act the Board is authorised to license such persons or firms as shippers as the Board shall deem expedient, and to approve of one or more receivers in such places or districts in Canada as the Board shall from time to time consider expedient. Because of the failure of the onion crop, the Colony's principle export to Canada, the Board did not consider it expedient in 1923 to make Regulations under the Act, which for this reason did not come into force.

At the Canadian National Exhibition held annually in Toronto, Bermuda winter-grown vegetables are brought to the notice of the Canadian public, and twice during the year under report the agricultural products of the Colony were advertised in Halifax newspapers. On the occasion of the visit to Bermuda of Mr. G. R. Stevens, Canadian Trade Commissioner, the subject of selling in Canada was very thoroughly discussed.

The efforts already made are not likely to greatly increase the sale of Bermuda vegetables in Canada. In 1922 a preliminary investigation of Canadian markets was made by Mr. J. J. Outerbridge, then a member of the Department, and every year a representative should be sent to the Dominion until a Canadian market has been established for Bermuda vegetables.

The English Market.—For three years experimental shipments of potatoes have been made to London, and information regarding that market has been gained. In 1923 a shipment of Bermuda Easter lily bulbs was made. The price obtained was not equal to that obtainable in the United States, but it is expedient to develop the trade, if practicable. Preparations were made in 1923 to advertise Bermuda bulbs and vegetables at the British Empire Exhibition in 1924. No development of this trade can be brought about until there exists adequate steamship service between the Colony and England.

FARM LABOUR.

In the report for 1922 it was stated, " Shortage of labour is the most important factor in maintaining the high cost of production and in reducing the area under cultivation." Since the above was written the situation has been greatly relieved by the introduction of farm labourers from the Azores. On Good Friday, 30th March, 1923, the first immigrants arrived, ninety-six souls in all, sixty men, eight women and twenty-eight youths and children. Homes had been found for them, chiefly with their own people. As a whole, these immigrants were quite satisfactory. Arrangements were entered into to bring out others, and in December one hundred and sixty left the Azores for Bermuda. Application for labourers and payments of contributions toward passage money were made to this Department.

FARM LIVE STOCK.

The quality of dairy animals is inproving. There are now eight or more pure-bred Guernsey bulls in the Colony, and the number of grade Guernsey heifers is increasing rapidly. Other breeds represented by a few good animals are Holstein, Ayrshire and Jersey in the order named. Time has not been found to organise a Dairy Cattle Club, which has been in contemplation since 1922.

Pigs show little improvement in quality, for there is scarcely any pure-bred stock in the Islands. The number of pigs has increased because of the abundance of hotel swill for feed, which should be fed with caution.

On 27th February the Bermuda Poultry Organisation Society was reorganised as the Bermuda Poultry and Pet Stock Association, and its indefatigable Hon. Secretary-Treasurer, Mr. W. R. Evans and other members are doing much to improve poultry. Greater attention should be given to breeding for production rather than for feathers. The marketing of eggs is deserving of concern. The poultry exhibits at the Agricultural Exhibition, 1923, were staged by the Association, which was also instrumental in securing from the Legislature a grant of seventy-five pounds to finance an egg-laying competition to be supervised by this Department.

Because of the lack of males of merit, goats are not improving, and the Department has now under consideration the importation of some well-bred stock. The rearing of rabbits for table use should be encouraged.

The local branch of the Society for the Prevention of Cruelty to Animals is doing excellent work on behalf of domestic animals, especially horses.

The report of the Government Veterinary Officer deals with the health of live stock.

ANNUAL AGRICULTURAL EXHIBITION.

The second Annual Agricultural Exhibition since 1914 was held at the Agricultural Station on 9th, 10th and 11th April. Its growth in one year is shown by the following figures :

Number of entries—	1922.	1923.
Horses	86	74
Cattle	46	59
Pigs	2	—
Goats	25	40
Rabbits	13	30
Poultry	37	163
Dogs	43	70
Cats	7	—
Fodders	—	2
Vegetables	88	302
Fruit	9	24
Flowers and Plants	181	356
Food Products	136	346
Arts and Crafts	291	768
Total	964	2,234

Number of prizes won, Adults	428	708
Clubs	135	278
Days open	2	3
Estimated attendance	6,300	9,000
Booths, display	1	5
,, sales	3	10
Financial, Receipts	£610 16 7	£849 14 6
,, Prizes paid	220 1 6	318 7 6
,, Expenditure, total	503 7 7	755 1 7

The Annual Agricultural Exhibition is a community effort, and its success depends greatly on the large number of workers who generously give their time and labour. The Department is under great obligation to all who assist, and this opportunity is taken of publicly expressing its appreciation.

BOYS' AND GIRLS' AGRICULTURAL CLUBS.

The Clubs show pleasing development due largely to the stimulus given by the Agricultural Exhibition of 1922. At the Exhibition of 1923 the number of entries received from Club members had greatly increased, and there was better quality in some classes.

The corn competitions of the year were in many respects the best for several years. The exhibits numbered fifty-four and the quality of many was highly commendable. For quality of exhibits the Clubs stood in the following order, the names of the schools are given :

1. St. Georges Grammar. 2. Seventh Day Adventist, Southampton. 3. Cedar Hill, Southampton. 4. Warwick Academy. 5. North Village, Pembroke. 6. St. Davids, St. Georges. 7. Whitney Institute, Smiths. 8. St. Marys, Warwick. 9. Southampton Glebe. 10. Berkeley Prepar., Pembroke. 11. Sandys Grammar. 12. Woodlands, Pembroke. 13. Central, Pembroke. 14. Temperance Hall, Hamilton. 15. St. Marks, Smiths. 16. Tills Hill, Pembroke. 17. Lyceum, Hamilton. 18. Cavendish Hall, Devonshire. 19. Spring Hill, Warwick. 20. Paget Glebe. 21. Huntley, Sandys.

The winners of the silver cups were as follows :

Cup presented by the Bermuda Green Vegetable Growers' Association for best ten ears of corn grown by a boy :

Brian Smith, St. Georges Grammar School.

Cup presented by Hon. W. E. Jackson, C.M.G., for best ten ears of corn grown by a girl :

Almeda Cowen, Cedar Hill School, Southampton.

Cup presented by Hon. J. P. Hand, M.B.E., M.C.P., for largest yield :

Almeda Cowen, Cedar Hill School, Southampton.

In August Major S. C. Hicks very graciously consented to superintend Club Work and is doing excellent work for the children of the Colony, and the Department is heavily indebted to him.

PUBLICATIONS.

The publications of the Department for the year included only the Annual Report for 1922, and the monthly issues of the Agricultural Bulletin. The Department is grateful to those who have contributed to the pages of the Bulletin. The Annual Agricultural Exhibition Catalogue brings the Department in touch with many who would not otherwise be reached.

The Royal Gazette and Colonist Daily and the Mid-Ocean have accepted for publication market information, instructions in plant disease and pest control, seasonable cultural notes and other matter, and appreciation for this courtesy is here expressed.

STAFF.

The Director of Agriculture, Mr. E. A. McCallan, was absent from the Colony on duty in the United States of America on two occasions, from 16th to 26th January, and from 16th June to 10th July. During his absence the Department was under the direction of Mr. J. J. Outerbridge, Second Agricultural Assistant, as Officer-in-Charge. The Director was appointed a member of the Immigrant Labour Board.

On 27th September, Mr. Lawrence Ogilvie, M.A., B.Sc. (Abdn.), M.Sc. (Cantab.), joined the Department as Plant Pathologist. Mr. Ogilvie received his early education at the Grammar School, Aberdeen, Scotland. Proceeding to Aberdeen University he studied concurrently in arts and science and graduated in 1921 as Master of Arts and Bachelor of Science, gaining in the latter degree " special distinction " in botany and zoology. He was awarded the Fullerton Research Scholarship of Aberdeen University, and proceeding to Cambridge, took up residence at Emmanuel College and undertook research in mycology at the Botany School. In the Michaelmas Term, 1923, Mr. Ogilvie was created an inceptor for the degree of Master of Science.

Mr. J. J. Outerbridge, Second Agricultural Assistant, terminated his connection with the Department on 9th October on promotion to the office of Clerk to the Trade Development Board.

Mr. G. E. Winter, Inspector of Produce, was absent on leave from 18th August to 15th October.

Dr. R. L. Tucker, V.S., Government Veterinary Officer, was absent on sick leave from 4th August to 3rd September. Dr. F. W. E. Peniston, V.S., acted for him during his absence. Dr. Tucker was appointed a member of the General Board of Health.

FINANCIAL.

The expenditure of £4,803. os. 6d. was authorised by the Appropriation Act of 1922, Act No. 4 of 1923, and Resolves Nos. 1 and 15 of 1923. Of this amount the sum of £4,163. 6s. 10d. was expended, and a balance of £639. 13s. 8d. remained unexpended. The sum of £73. os. 11d. was received from sales and other sources, and was reimbursed to the Treasury. Statements of the expenditure under all sub-heads and of the receipts will be found in Appendices C and D.

During the last ten years the expenditure by the Department, exclusive of salaries, and the receipts at the Station, have been as follows :

Year.	Expenditure.	Receipts.
1914	£3,042 2 3	£32 14 0
1915	2,529 18 0	89 3 4
1916	2,497 19 0	163 18 10
1917	2,045 5 7	156 2 10
1918	2,051 8 0	376 3 4
1919	2,722 5 8	157 18 0
1920	3,128 6 6	209 4 6
1921	5,488 15 2	176 1 11
1922	6,905 18 2	68 17 4
1923	4,163 6 10	73 0 11

Respectfully submitted,

E. A. McCALLAN,

Director of Agriculture.

Agricultural Station, Bermuda,
28th May, 1924.

Preliminary Report of The Plant Pathologist For The Period September 27th to December 31st, 1923.

The Director of Agriculture.

I have the honour to submit the following report of work done during the three months from the date of my arrival here to the end of the year 1923.

I wish to record in this report my appreciation of the warm welcome given me by you, by the members of the Board of Agriculture, and by the farmers and people of Bermuda. I am indebted to you personally for the time you have spent in making me acquainted with the chief problems.

In a preliminary survey of the field during these three months it is evident to me that there is abundant scope for plant pathological work here. Prof. H. H. Whetzel, to whom I am indebted for suggestions and advice previous to my coming here, has made a careful study of the chief diseases and pests of the economic crops and has been instrumental in introducing dusting methods for their control.

Much remains to be done, however (1) in the fuller investigation of the biology of the most important pathogens, *i.e.*, of the ways in which they are carried over from season to season and of their relations to wild plants.

(2) In the study of the diseases and pests of fruit trees and ornamental plants. I am confident that avocado, citrus, figs, peaches and annonaceous and other fruits will in time be grown here abundantly once more, provided sufficient attention is given to cultural methods, study of the most suitable varieties, and control measures. In connection with the last there is scope for the introduction of natural parasites.

The diseases of ornamental flowering plants have not been worked out as have those of economic plants and some time will have to be given to the study of these. The diseases of the Bermuda lily (**Lilium Harrisii**) are a problem in themselves. I am always ready to report on specimens submitted to me.

(3) In elaborating control measures for the new pathogens discovered and in perfecting those already in use.

(4) In perfecting the quarantine system now in force. All the serious diseases and pests of plants in Bermuda have been imported on nursery stock and other plants mainly from the West Indies, United States of America, and Europe. The introduction of a system of fumigation of imported plants such as is in force in many of the British colonies is, I consider, quite essential. The present embargoes should be extended.

(5) In educating public opinion on plant pathological questions by means of public addresses and demonstrations, exhibits at shows, articles in the Agricultural Bulletin and the press, and talks with farmers. I look to the farmers and others to inform me promptly of outbreaks of disease and to assist me as far as possible with my work.

(6) In working up collections of Bermuda fungi, insects, etc., Prof. Whetzel made extensive collections during his stay here, and I hope to continue this important work as far as time permits. I am indebted to Prof. Whetzel for placing the identifications of his collections at my disposal and for many suggestions. I have also to thank the Imperial Bureau of Entomology, London, for their kind assistance in the identification of specimens.

The dry weather during the three months under consideration has not been favourable to fungoid attacks, but a number of interesting cases fall to be recorded. Insect damage has been severe in some cases.

Following is a list of the chief diseases and pests which came under observation during the period under review :

Avocado.—Among the insect pests of avocado in Bermuda are a red spider (**Paratetranychus** sp.) which causes severe bronzing of the upper surfaces of the leaves and a small yellow leaf-hopper (**Empoasca minuenda**). These should be kept under control by a routine spraying of weak lime sulphur as is recommended against the powdery mildew (**Oidium** sp.).

Banana.—The banana borer (**Cosmopolites sordidus**), whose presence here was noted by Prof. Whetzel, is apparently of serious importance only where bananas are grown in unsuitable soil or situation or where the plants are otherwise weakened. Effective control measures have been elaborated by Mr. C. C. Gowdey, Government Entomologist, Jamaica. An article giving a summary of these and of the life history of the borer has been submitted to the local press.

A large plantation of bananas (**Musa Cavendishii**) in Smiths Parish was reported to be in an unhealthy condition, and at the request of the owner I made a thorough examination of the plants. The most marked features were the large number of dead leaves surrounding the stem, the rotting of the outer leaf-sheaths, and the failure of the bunches to mature. There was no evidence of the presence of any pathogenic organism. The condition of the plants was attributed to a complex—poor soil, a windy situation and borer attack.

A special report has been prepared dealing with the possibility of the introduction of the Panama Diseases of Bananas into Bermuda.

Bamboo.—The two scales, **Asterolecanium bambusae** and **A. miliaris** are common on bamboos in Bermuda, the former on the stems, the latter on the twigs and leaves. Neither is of serious importance.

Beans.—A disease of lima beans caused by a species of **Phoma** came under observation in November. The symptoms are a profuse reddish-brown mottling and streaking of stems and leaves and dropping of the pods before they are mature. The same organism was isolated from lesions on stems and leaves. Spraying with Bordeaux mixture and burning the old plants was recommended. A mosaic disease of string beans is apparently fairly widespread. American workers have demonstrated that in this case the virus is carried in the seed. Powdery mildew (**Erysiphe polygoni**) was also frequent in November. It can be controlled in severe cases by dusting with sulphur. The leaf-hopper **Empoasca mali** was the cause of severe burning of the leaves of the fall crops.

Beets.—The so-called fireworm of beets has been identified as the " Hawaiian beet webworm " **Zinckenia** (**Hymenia**) **fascialis,** a form which is practically cosmopolitan. It is the cause of severe damage to the leaves of the early fall crop. It is easily controlled by dusting with arsenate of lead dust.

Cabbage.—The larva of the small fly **Agromyza pusilla** is a serious pest as a leaf miner on seedling cabbages and related plants. There is no known method of control. The caterpillar of the noctuid moth **Phytometra brassicae** is not uncommon on cabbages, but it is not of any great importance. Black rot caused by **Bacterium campestre** is, as recorded by Prof. Whetzel, the most common disease of cabbages and related cruciferae in Bermuda. During the period under review, however, it does not appear to have done any serious damage.

Cassava.—The mite **Tetranychus telarius** caused extensive injury to cassava leaves in November. It can be controlled by dusting with sulphur.

Citrus.—The most important citrus pest in Bermuda is probably the purple scale (**Lepidosaphes beckii**) which is too well known to require description. The Yothers lubricating oil emulsion spray in use here is very valuable for the control of this scale. Perhaps the chief cause of the decline in citrus growing here is the disease known as " gummosis," which, as its name implies, manifests itself as a profuse gumming of the trunk and twigs of the trees, accompanied by a scaly appearance of the bark. The disease has been known in Florida for a number of years, but has attracted attention only recently. It develops and spreads rather slowly but in many cases causes severe damage, if not the loss of the tree. The cause is as yet undetermined. In treating the disease remove all dead and discoloured bark down to the healthy wood and apply some antiseptic such as white-lead paint, carbolineum or lime-sulphur diluted 1·10 to the exposed tissues. The disease known as " black melanose " causes greasy spots on the leaf surfaces. It is not serious.

Corn.—The beetles **Araecerus fasciculatus** and **Calandra oryzae** are destructive pests of stored corn. They may be killed by putting the material in a shallow baking pan and placing it in an oven. Exposure to a temperature of 125° to 135° F. for several hours will kill all grain insects. Exposure to such temperature for not over six hours does not injure the germinating qualities of the grain.

Crab grass.—The common crab grass, **Stenotaphrum secundatum,** the principal lawn and pasture grass in Bermuda, is not uncommonly attacked by a fungus of the genus **Cercospora,** which causes it to die off in circular patches. The grass is often slightly attacked and it is only in shady situations that the fungus appears to do much harm. Spores are produced on the dark linear areas on the leaves. The treatment recommended, thorough soakings with Pyrox solution at intervals of a week, proved effective in checking the disease.

Eddoes.—The mealy bug **Pseudococcus longispinus** has to be recorded from eddoes (Colocasia antiquorum).

Egg Plant.—A destructive blight caused by the fungus **Phomopsis vexans** has been found in all parts of the islands. It attacks leaves, fruits and stems. On the leaves large brown areas are produced on which appear later the black fruiting pustules. The fruit is penetrated by the fungus mycelium and succumbs to a soft rot. Stem attacks are characterised by dark sunken lesions which often extend all round and cause the parts higher up to wilt. The fungus is carried over from season to season on the seed and on old diseased plants which have been left in the ground. Diseased plants should be pulled up and burned. Only vigorous seedlings without any trace of the disease should be set out in the field. Spraying with Bordeaux mixture or dusting with copper-lime would probably check the spread of the disease if undertaken in time.

Lettuce.—The lettuce beds at the Agricultural Station were severely attacked by "drop," caused by the fungus **Sclerotinia libertiana.** Loss in cos lettuce amounted to over 25 per cent. in twelve beds, each of a different variety. Little or no loss was observed elsewhere. It is important to remove diseased plants as soon as they are noticed.

Lilies.—My attention has been directed to various lily diseases. At least four characteristic diseases were observed.

Dwarf yellow.—I give this name to plants which are backward in comparison with the normal crop and are noticeable on account of their pale flaccid leaves. The roots are unhealthy looking and few in number. The bases of the outer bulb scales are crowded with mites. No fungus was found to be present in three cases examined.

I am greatly indebted to Mr. H. E. D. Smith for bringing me specimens of plants suffering from what are apparently three distinct diseases, namely :.

Twisting.—A disease very prevalent this year and remarkable for the peculiar twisting of the leaves it causes.

Mosaic.—A distinct disease noticed this season. The leaves have pale longitudinal stripes but no twisting is seen. Severe cases may have brown longitudinal scorched stripes.

Yellow flat.—The plants are flat and yellow and the leaves curled from the tip. Leaves and scales become yellow and wither.

The cause of these diseases is obscure, possibly nutritional, possibly due to mite injury, possibly of the same nature as mosaic diseases. They merit close attention. A paper published in 1897 by A. F. Woods on " The Bermuda Lily Disease," characterised by the spotting and distortion of the leaves and usually of the flowers and spotting of the scales of the bulbs and agreeing somewhat with Mr. Smith's twisting attributes it to a combination of causes—weak plants and the attacks of mites and certain fungi and bacteria. This is very vague.

Extremely little Phytophthora rot has occurred this season. Heart rot, due to allowing castor pomace to settle on the heads, has been observed.

Loquats.—The most serious pest of loquats in certain localities is a small brown caterpillar which attacks the flowers and developing fruit, matting them together with a web. Spraying with lead arsenate solution ($\frac{1}{2}$ ounce powder to a gallon of water) has been recommended. The addition of $\frac{1}{2}$ lb. of sugar per gallon of water will help in checking fruit fly injury. I am in communication with Dr. L. O. Howard of Washington, regarding the practicability of introducing parasites of the fruit fly into Bermuda.

Oleanders.—**Aphelinus diaspidis,** a chalcid parasite of the oleander scale (**Aulacaspis pentagona**) has been bred from scale collected from widely separated parts of the islands. This parasite which is a very active minute, almost microscopic, yellow fly, was introduced on the consignments of parasitised scale imported here from Italy by Prof. Whetzel. There are indications that in some parts of the islands it has been instrumental in keeping the scale under control.

Papaw.—The black scale (**Morganella longispina—M. maskelli**) recorded by Prof. Whetzel from figs is occasionally destructive to papaw stems. It may be cleaned off by spraying with lime sulphur 1·10.

Potatoes.—Early blight (**Alternaria solani**) appeared markedly in the Triumph fields in the first and second weeks of December, but as the plants were by that time well on little injury resulted. Fields which had been systematically dusted showed little blight.

Large areas of potatoes failed to germinate in certain fields in Southampton. The bare patches were typically well defined and had often started apparently from the edge of the field. The disease was apparently especially destructive this year. The farmers attributed the failure of germination to something in the soil. Favouring this theory were the following facts :

1. The disease was not confined to any particular type of soil, but was found in the light limy soils and red loams (the latter with p.H. 8·85).
2. It had evidently spread from the original areas and was not stationary.

It was evidently not carried by the tubers as it appeared in these well defined areas.

Examination of the tubers, which in every case had been cut, showed a normal appearance, except in the fact that the eyes had failed to produce any marked growth (a fortnight or three weeks after planting). In severe cases the eyes remained small and wart-like, in others spindly shoots were produced which gave rise to successive tiers of roots. Cross sections of the tubers showed them to be sound and free from anything suggestive of a fungoid or insect disease. In some cases the tubers had rotted away and were covered with minute white objects which proved to be the mite (**Rhizoglyphus echinopus** = **R. hyacinthi**).

No fungoid organism was found in the sprouts, but in practically every base mites were found, although in small numbers, right at the bases of the shoots.

The disease has already been described by Prof. Whetzel in the report of this Department for 1921. He was inclined to ascribe it to the action of the mites. The gradation of aborted to spindly shoots from the centre to the outside of the bare areas as described by Prof. Whetzel was not observed.

An experiment was carried out to determine the cause of the failure of germination, but did not produce conclusive results. Briefly, tubers artificially infected with mites produced healthy plants. Diseased soil from the fields, on the other hand, appeared to prevent the normal growth of the tubers, except when the potatoes were well sprouted before planting ; the addition of 5 g. of sulphur per five-inch pot did not remedy matters. No mites were observed on the young buds or at the bases of the malformed shoots, although they were present in dark patches on the tubers. Control tubers produced healthy plants.

It is hoped to repeat the experiment with larger numbers of mites.

Most of the so-called " rust " or tip burn seen in the Triumph fields in November was due to the potato leaf-hopper (**Empoasca mali**), a small green insect which appears in great numbers when the plants are shaken. The burning effect, due to some noxious substance injected by the insect into the leaf, begins at the tips and later extends to the margins. Bliss Triumphs are particularly susceptible. Copper-lime dust has little effect on them, as evidenced by the severe attack at the Station and elsewhere. Bordeaux mixture (4-4-50) is stated to give complete control as a deterrent.

The aphid **Myzus persicae** was prevalent in the fall crop and in one instance rather severe damage was done by a flea beetle (**Epitrix parvula**).

A common pest of Triumphs stored during the summer is the mealy bug, **Pseudococcus citri,** also found on geraniums, etc. It can be washed off easily with water. It is recommended to store the tubers in clean boxes.

Palmetto.—On the native palmetto (**Sabal blackburnianum**) the scale **Comstockiella sabalis** has been observed in several parts of St. Georges. The same measures as those taken by Prof. Whetzel, namely, cutting down infested trees, are being used against it.

The palm **Livistona chinensis** extensively planted in Bermuda is often somewhat severely attacked by an aphid **Cerataphis lataniæ** closely resembling a scale. It may be removed by spraying with lime sulphur 1-10.

The scales **Chrysomphalos aonidum, C. dictyospermi** and **Diaspis boisduvalii** have been found on small unidentified palms, known locally as Kentias. These are best got rid of by spraying with a kerosene emulsion.

Roses.—The weevil **Exophthalmus esuriens** was found to be destructive to rose leaves in one locality.

Sugar apple. (Annona squamosa). The white scale found so commonly on sugar apples (**Pseudococcus nipæ**) is easily controlled by spraying with lime sulphur 1-40.

Sweet potatoes. Cases of damage by "red spider" (**Paratetranychus tumidus**) were checked by dusting with sulphur. A leaf spot (probably **Phyllosticta bataticola**) was fairly common in October.

The flea-beetles **Epitrix parvula** and **Chaetocnema apricaria,** were common in certain fields.

EXAMINATION OF IMPORTED STOCK.

Two hundred and thirty-five boxes of plants and bulbs imported through the post, three crates and one small consignment of bananas, were examined during the period under consideration. A scale intercepted on cycads from the West Indies proved to be **Aspidiotus destructor,** an important species not yet found in Bermuda. One specimen of oleander scale (**Aulacaspis pentagona**) was found on a pot plant similarly imported.

VISITS TO FARMS.

Over fifty visits to farms were made in the three months.

Respectfully submitted,

LAWRENCE OGILVIE,

Plant Pathologist.

Agricultural Station, Bermuda,
28th May, 1924.

Report of The Inspector of Produce For The Season of 1922-1923.

The Director of Agriculture.

I have the honour, under the provisions of The Agricultural Inspection Act, 1921, to forward my report on the inspection of produce and lily bulbs shipped from the Colony during the season 1922–1923, and of seed potatoes imported during the same period, also on the marketing of Bermuda produce in New York.

INSPECTION OF SEED POTATOES.

The first duty of the period covered by this report was the inspection of Garnet seed potatoes imported during October and November, 1922. The seed appeared, on the whole, to be good; a few lots from Cornwallis, however, were not so good-looking as the bulk of the imports, and showed some rot. During February, 1923, Triumphs from New Brunswick arrived to be planted in order to raise seed for the following fall crop. These appeared to be of very good quality. Irish Cobblers came in March, 1923, to be grown for summer use locally. They presented a very good appearance. Triumph seed was inspected in August and September, 1923. 3,888 barrels were imported. While the importation on the whole was of good quality there was in many cases an obvious lack of care in the matter of packing and containers, the packing being very slack and the containers in very poor condition.

INSPECTION OF PRODUCE.

Green Vegetables.—The green vegetable season opened with the shipment of 10 crates on 28th November, 1922, and closed on 23rd June, 1923, with 437 crates of celery. Taken as a whole, the green vegetable crop was good.

Beans, Fava.—Disease made serious inroads upon the fava beans this season, rendering the yield small and the quality inferior.

Beets.—As mentioned in my market report the too exuberant foliage and the coarse, light-coloured flesh of the beets of last season proved a serious drawback.

Carrots.—The carrots this season were mostly of the long variety so much favoured in the New York market.

Celery.—Celery was the largest crop of that product ever exported from the Colony.

Kale.—There was a pronounced improvement in the quality, appearance and packages of the kale exported.

Lettuce.—The lettuce crop was no improvement on that of last year which was described as a complete failure.

PARSLEY.—Parsley was generally good. The attention of farmers should be called to the necessity of not cutting and packing too long before the time of receiving for shipment.

Onions.—The onion crop was extremely poor, due almost entirely to blight. The yield was less than 50 per cent. of that of 1922.

Potatoes.—The fall crop of potatoes for the year 1923 was about 30 per cent. below that of the previous year, which itself was well below the average. This was due mainly to two causes, continuous high winds and poor seed. For several years past there has been observed a lack of vitality in the seed imported from Long Island, New York. This defect showed up more prominently than ever during the past season. The seed from New Brunswick was a good strain of Triumphs, but unless it can be reaped earlier in the north, it does not appear to me profitable to plant it in Bermuda for a fall crop. Several farmers told me that they had had a very good yield from the Cobler seed. The spring crop was somewhat lighter than that of the previous season, which was considerably below the average. The chief contributory causes of the light spring crop were (1) drought, and (2) blight.

Produce Rejected on First Inspection.—The percentages of rejections on first inspections were as follows : onions, 9·2 ; potatoes, 1·9 ; celery, 2·4 ; other vegetables, 1·7. The bulk of the produce rejected on the first inspection was made good with respect to the defects found in it, and was shipped.

Appeals.—None.

Prosecutions.—None.

Space for Re-packing.—I have again to thank Captain N. E. Holmes, Wharfinger, for the allotment of space for repacking, as well as for his kind co-operation in overseeing the stowage of the chill-rooms.

Quantities of Produce Shipped.—The following quantities of produce were shipped :

	Canada.	West Indies.	United States.	Total.
Beans, Fava ...	—	—	1,734	1,734 bushel crates.
Beets	—	—	28,007	28,007 ,, ,,
Cabbage	279	—	—	279 ,, ,,
Carrots	74	—	60,820	60,894 ,, ,,
Celery	40	—	40,262	40,302 ,, ,,
Kale	—	—	16,302	16,302 ,, ,,
Lettuce	—	—	3,041	3,041 ,, ,,
Onions	5,875	8,517	20,784	35,176 ,, ,,
Parsley	—	—	40,688	40,688 ,, ,,
Potatoes	—	123	33,481	33,604 barrels.
Tomatoes	1,024	—	—	1,024 bushel crates.
Turnips	—	—	1,083	1,083 ,, ,,
Miscellaneous ...	—	—	620	620 ,, ,,

Total number of green vegetables shipped, 193,974 bushel crates.

Recommendations.—The greatest care should be exercised by importers of seeds to secure the best seeds of the most suitable varieties of vegetables. The question of expense should be little regarded. Seed true to type is always worth its price.

I would again strongly urge the imperative necessity of a standard pack, especially of beets and carrots, such as is adopted by Texas and other competitors with Bermuda produce.

Acknowledgment.—I have to express my thanks to the Assistant and Sub-Inspectors for the valuable work they did during the season, especially to Mr. E. L. Adams, who acted as Assistant Inspector-in-Charge during my absence in New York.

MARKETING OF PRODUCE IN NEW YORK.

[The following abstracts are from the Inspector's comprehensive report on the subject. Director.]

February 10th. Left Bermuda by the S.S. Fort Victoria.

Tuesday, 13th February. Began unloading at 7 a.m. from all hatches. The cargo proved to be in very good condition. Unloading proceeded with breakages almost nil. This satisfactory result is due, in my opinion, principally to the employment of platform slings both at Hamilton and New York.

Thursday, 15th February. As the temperature was at 10° above zero I requested the Steamship Company to hold the potatoes on board until next morning, which they did.

Monday, 19th February. The ship had to go into dry dock that afternoon owing to an accident to her propeller. I endeavoured to persuade the Company to discharge the cargo before the vessel was laid up, but as the dock was available only that afternoon, this was impossible.

Monday, 26th February. On observing a larger number than usual of broken crates I went into the chill-rooms to investigate and satisfied myself that the breakages had occurred at the Bermuda end. Reported this matter to the Director of Agriculture.

Thursday, 1st March. Found a considerable portion of potatoes very much off colour, pointing to lack of proper care by the farmers when storing. A good many barrels were broken. Wrote to Assistant-Inspector Adams urging strictest attention to coopering of barrels.

Monday, 5th March. A small experimental shipment of potatoes in the new " fibopak " container arrived. Containers much broken and mutilated. I fear this " fibopak " will not answer the demands of our trade.

Monday, 19th March. Very cold weather predicted for this night, so had potatoes held on board ship until to-morrow morning.

Monday, 9th April. Most of the vegetables, especially parsley, came out of No. 3 chill-room in very poor shape. Some were so bad that they had to be dumped, 31 crates being left on the dock as worthless. Looks as if the farmers might suffer heavy loss. Will know definitely on getting into market.

Tuesday, 10th April. I found this morning that my misgivings respecting the parsley were to a great extent justified.

Friday, 13th April. After collecting all the information obtainable I estimate that the total loss on the Fort Victoria's cargo of vegetables will be about five or six hundred dollars.

Monday, 16th April. I observed that the celery is not of the variety which is best favoured by the buyers. They claim that the kind now being forwarded is too tall and lacks quality.

Wednesday, 25th April. Observed to-day a new factor in the onion situation—a consignment of Florida onions, the first ever sent from that State.

Monday, 11th June. Arrived in Bermuda and resumed duty there.

Saturday, 16th June. Left Bermuda for New York by S.S. Fort Victoria with Director of Agriculture. Chill-room temperature during the voyage satisfactory.

Monday, 18th June. Arrived Pier 95 at 1 p.m., and in company with Director of Agriculture, visited Washington Market and interviewed many of the receivers. No cargo discharged this day.

Tuesday, 19th June. Interviewed other receivers with Director of Agriculture.

Wednesday, 20th June. Temperature to-day 96° in the shade. Celery handicapped. If it had arrived on Monday, 11st inst., or even been discharged immediately on arrival last Monday sales would undoubtedly have been much higher. A heavy loss will be made. It is estimated that the loss to celery growers amounted to more than $24,000.

Saturday, 23rd June. Left for Bermuda.

Wednesday, 27th June. Arrived in Bermuda and resumed duties.

Remarks.—(1) Discharging from ship to dock was quite satisfactory.

(2) Texas, as mentioned in previous reports, is a strong competitor and Florida has now entered the field with onions. These facts should impress deeply on the farmers the imperative necessity of shipping only the best quality, packed in the most attractive form.

(3) Potatoes this season showed very little rot but were lacking in size and colour, due in some measure, perhaps, to the season; the Triumph crop showed also want of care in storing while in Bermuda. I have not the slightest doubt that at least $1.00 more per barrel could have been realised had the potatoes reached a proper standard in size and colour.

(4) I desire to express my appreciation of the courtesy and consideration shown me in the discharge of my official duties by the officials on the dock at New York.

Recommendations.—(1) I would call attention to the desirability of introducing other vegetables in the New York market as recommended in my last year's report.

(2) I would also again recommend a reduction of the number of receivers in the New York market, particularly for celery.

(3) I would repeat that No. 3 grade potatoes should be cut out altogether. This grade is difficult to sell at all times and is often quite unsaleable.

(4) I am more convinced than ever that a standard pack of all vegetables, and especially beets and carrots is an indispensable condition to our maintaining a place in the New York market.

(5) The experiment with the chain stores should be entered upon with the opening of the season next year and fully tried out. The small scale of the experiment during the past season rendered it inconclusive.

(6) The fibopak and the burlap containers for potatoes and vegetables were tried during the past season without success. I feel satisfied both are unsuitable for the Bermuda trade.

INSPECTION OF LILY BULBS.

This work was carried out during July and August, 1923. The five packing sheds were frequently visited, and all bulbs carefully inspected. All bulbs showing stump-rot were rejected. A considerable quantity of longiflorum bulbs was observed. Some of the packers show improvement in quality of bulbs packed. It is estimated that the farm value of the bulbs exported amounted to £15,000.

Total number of bulbs shipped, 562,000.

OTHER SUMMER DUTIES.

When not engaged in the inspection of lily bulbs, I was engaged in supervising Agricultural Club work, revising the agricultural registers on file at the Agricultural Station office, visiting farms, and performing other duties as directed.

Respectfully submitted,

G. E. WINTER,

Inspector of Produce.

Devonshire, Bermuda,
17th January, 1924.

Report of the Government Veterinary Officer for the year 1923.

The Director of Agriculture.

I herewith submit my annual report for your approval and for the information of the Board.

The year that has just passed has been, from the general live stock standpoint, a very successful one, inasmuch as several new issues have arisen, and owing to the experience gained by years of service as an official, they have been met and overcome. The numbers of live stock imported into the Colony have far exceeded the records of previous years, and you will appreciate that with this increase in numbers, greater risk of the entrance of diseases in the Colony has been introduced ; and I am pleased to report that with one exception, namely, influenza equina, no special outbreak has come under my observation. Of course hog cholera to a greater or lesser degree is always with us, though seldom in the form of an existant disease, but in the microscopical germ form, and this may make its appearance within a limited area and, unlike most of the swine plagues, remain quiescent for a number of years, and then in unlikely districts break out again, but as a general rule, in a mild form ; and if it is possible to impress on the owners of hogs to have their animals vaccinated every season for, say, over a period of five years, I am confident that these outbreaks would occur not more frequently than eight years, because the germ finding no special host wherein to germinate would become so debilitated that only a mild form, or possibly permanent immunity, might be brought about.

I would at this time emphasise the fact that the diminution of serious diseases in the Colony, taking into consideration the increase in the numbers of live stock imported, is due greatly to rigid inspection, and following up of non-tested animals and insisting that they shall be subject to scientific test for verification of diseases. To make sure that there may not exist some means of a better service with which I had not been conversant, I sought an interview with Dr. Andrew Balfour when on his recent visit here. He very kindly afforded me a lengthy interview, and accompanied me into the vessel's hold and saw the inspections made, as well as receiving from me descriptions of my methods of test for glanders, farcy and tuberculosis in cattle. We talked over matters relative to diseases of live stock affecting the human subject, and from his personal statement to me, he appeared to me satisfied with my methods of inspection. He made one very valuable suggestion, which had previous to his visit been discussed by the Board, namely, the inoculation of dogs against rabies. I wish to say here that my interview with this specialist was very much appreciated from a scientific, as well as an educational standpoint.

During the year one very important regulation has been made, namely, the dairy regulations by the General Board of Health which affect the sanitation of dairies and the sale of milk, and I can assure you that some of the milk offered for sale in this Colony is not up to the desired standard.

The erection of a detention hospital has been approved of by the Board. By its use all animals that are in any way suspicious of disease may be held until a correct diagnosis can be made of their special ailment, and while I do not anticipate that the hospital will be very much used, still the erection and use of such a place will make possible the verification of the diagnosis of the disease from which an animal may be suffering on arrival in the Colony.

I wish to make some mention in this report concerning the efforts of the Police Department, of which I am the official veterinarian. Much credit is due them for the way they have followed up reported cases of cruelty to animals, cases that do not come before the courts, but in which the owners have received advice whereby animals have been made more comfortable during the performance of their work. Not a few of these reported cases are due to ignorance rather than intent to practice cruelty. I wish to thank the Department for the assistance they have afforded me at different times in the performance of my duties.

I would be derelict in my duty if I did not in this report make some comment on the exhibits of the different kinds of live stock at the show in 1923. On the whole it was an exhibition which reflected credit on every one that was connected with it, and more especially to you as Director of Agriculture. It not only demonstrated to my mind the willingness of everybody to work, but a thorough co-operation between yourself and the officers of your Department. The live stock was far beyond all expectations, more especially in the poultry class, varieties there were without number and some of them remarkable individuals, specimens that would have done credit to many larger exhibitions of this kind. Pure-bred cattle were in goodly numbers, and the stock raised by the juveniles was a credit to them. The horses in every class from standard-breds to drafts were far above the average, and many showed great care in their preparation and equipment.

The number of animals imported is given in Appendix B.

In conclusion, I wish to thank you as Director of Agriculture and the Board for the ready attention and adoption of my recommendations during the year, and you will, I hope, see by my next report that confidence has not been misplaced by assenting to such recommendations.

Respectfully submitted,

R. L. TUCKER,

Government Veterinary Officer.

Brightside, Flatts,
27th May, 1924.

Report of Second Agricultural Assistant On Visit to Canada

To inspect Seed Potatoes and to supervise the Bermuda Booth, Canadian National Exhibition.

The Director of Agriculture.

SEED POTATOES.

Triumphs near Fredericton, New Brunswick.—The Triumphs under cultivation by the New Brunswick Brokers, Ltd., showed marked improvement in freedom from disease, less than one-half of 1 per cent. leaf-roll being found and 8 per cent. mosaic. Stock growing on light sandy soil showed signs of ripening at the date of inspection (2nd August), but other fields, situated where the soil was much heavier, although in some cases much higher than the first mentioned, were in vigorous growth and full flower. The New Brunswick Brokers are keen to produce good seed, and immediately after inspection an experienced man was employed to thoroughly rogue out all diseased plants. Selections are being made for seed stock to be used in Fredericton for planting next year.

A field of about two acres of Triumphs grown from seed secured from the Agricultural Experiment Station in Maine, and said to have come from J. W. Smith stock three years back, was inspected and found to contain 3½ per cent. leaf-roll and 33 per cent. mosaic. This field was ripening back.

Chili Garnets in New Brunswick.—The New Brunswick Brokers, Ltd., have under cultivation a small field of Chili Garnets, grown from stock secured from Clifton, Nova Scotia, last year. This stock showed a vigorous growth, and only 1 per cent. leaf-roll was seen. Every plant showing questionable development has since been rogued out ; this included all weak plants. The New Brunswick Brokers, Ltd., plan placing their certified seed on the market under the trade names of "New Brunswicker Triumph" and "New Brunswicker Garnet."

Chili Garnets in Nova Scotia.—The plantings of Chili Garnets in Nova Scotia for the Bermuda trade have been reduced by some thirty-six acres this year, but the stock that is growing shows a very marked improvement over previous years. A keen desire is shown by almost every grower to still further improve his seed. The stock seen in Clifton was, on the whole, superior to that seen elsewhere. Masstown is later and the acreage small. Stock grown on the South Mountains in Cornwallis is very promising, but in the hands of poor growers. In all, one hundred and fifty-five acres were inspected in Nova Scotia. Of these one hundred and twenty-nine were accepted and twenty-six condemned. A high standard was maintained, nothing showing over 2½ per cent. leaf-roll being accepted, and no field being considered that was planted within fifty feet of any other variety.

A word of appreciation must be expressed for the wholehearted co-operation of Mr. W. K. McCulloch of the Dominion Department of Agriculture, without whose planning and assistance it would have been impossible to have covered the ground in the short time at my disposal.

THE BERMUDA BOOTH.

The opening on August 25th of the forty-fifth Canadian National Exhibition, found Bermuda, as in the previous two years, represented, and prepared with a booth ready to receive visitors and dispense information. Included in the exhibits were tubbed plants, bulbs, specimens of nursery stock, vegetables and fruit; the latter were exhibited in attractive jars purchased especially for the purpose. Among the plants were large specimens of bananas and papaws in full fruit. These attracted great attention, and were the means of drawing large numbers of visitors to the Bermuda booth. The background of the booth was decorated in green and white as heretofore and the floor covered in grass-green denim. All tubs and fixtures were painted in the same shade of green. The framework, including columns and arch, were painted in white enamel, with the lettering in green and gold. The outward appearance of the booth was unaltered, it being impossible to make any appropriate change with the small amount allocated for the purpose. The miniature white stone house was again used to advantage. A handsome display of some of the beauties of the deep was made in a large show case secured for the purpose. Pictures of scenic beauty, agricultural subjects and Bermuda winter sports were shown on a stereomotograph machine. In the centre background of the booth was displayed a large coloured map of the Bermuda Islands, surmounted with a six foot shield showing the Bermuda coat-of-arms. Owing to the limited space it was impossible to use to advantage all the exhibits, so some were returned to storage.

The Bermuda booth was the recipient of criticisms as well as compliments. Among the visitors were many Bermudians who are beginning to appreciate the fact that Bermuda should show her very best at an exhibition that is drawing nearly a million and a half in attendance each year. Among the compliments received, one paid by Mrs. Lydia Pankhurst is worthy of record. "The Bermuda booth is the gem of the Exhibition. It accomplishes its purpose, for any one seeing the exhibit cannot help but long to visit the Island." This, she said, had been decided at a meeting of ladies that afternoon.

A mark of appreciation is recorded for the generous way in which Superintendent Collins of the Toronto Parks Department placed plants at our disposal for use in decorating the booth.

The following suggestions are made in connection with future exhibits:

(1) Begin to prepare exhibits well ahead. This is essential for success.

(2) Have sufficient appropriate literature for distribution, and preferably have it printed in Canada.

(3) If possible, make a complete change in the exhibits.

(4) Accept more space, even if divided by a passage way.

(5) Plan for and erect a Bermuda building some time in the near future.

The Canadian National Exhibition has operated successfully for forty-five years, each year increasing in size and attendance, and is likely to continue operating for another forty-five years and longer. Almost a million and a half were recorded as having passed through the gates this year, and of these by far the larger part were visitors, most of whom were from the United States. The Canadian National Exhibition is recognised by Great Britain, United States, France, Cuba, Mexico and other countries as one of the best advertising mediums, and Bermuda should not overlook this fact.

Respectfully submitted,

JOSEPH J. OUTERBRIDGE,

Second Agricultural Assistant.

Agricultural Station,
September 18th, 1923.

Special Report by Professor H. H. Whetzel.

To the Board and Director of Agriculture of Bermuda.

Gentlemen,

Having once more had the pleasure, through your kindness, of an opportunity to spend a few delightful days in your country at your invitation and expense, I feel under the pleasant obligation of submitting for your consideration a brief summary of my observations on the disease and pest situations in the Islands. I am also making some suggestions which may perhaps prove of interest in the further development of your agricultural programme.

Before proceeding to a consideration of the above indicated matters, I take this opportunity to express to you all the keen appreciation I have of your confidence in my ability to be of service to you, and beg to assure you that nothing has given me greater pleasure than the opportunities I have had to serve Bermuda and her agricultural interests. I shall always look back to the days I have spent in Bermuda with keenest pleasure and satisfaction, and shall hope that the future may bring me many more times to your delightful island country.

THE PLANT DISEASE SITUATION.

Returning to Bermuda almost a year after I left it in June, 1922, I was naturally interested to see to what extent the plant disease and insect pest problems had changed from that of a year ago. A year ago this time Bermuda was passing through a severe dry spell. On this visit I found the country in the midst of an exceedingly wet season. Since the weather plays a very important part in the character and severity of plant diseases, I was not surprised to find a very different plant disease picture before me as I rode about the Islands.

Among the new problems which I at once discovered, the most striking were the onion blight and the snapdragon rust. The late blight of potatoes, too, which was almost entirely absent in April, 1922, was spreading devastation in many fields of Garnets in April, 1923. In short, the wet season had brought several disease problems, perhaps more of them than the previous dry season. The evidences all indicated to me that farmers would lose more from disease in their crops this year than they did last.

I shall now briefly consider a few of the more important disease problems of 1923 as they appeared to me from the brief survey I was able to make. I feel that I have a reasonably accurate knowledge of the actual situation as it appeared during the early days of April, as I took occasion to visit farms throughout the Islands from Somerset to St. Davids, giving special attention to onions, potatoes, celery and lilies.

Onion Blight.—The first onion field which I saw on my way from the steamer to the Station presented a picture which was all too familiar to me, although I had not seen it within fifteen years. I recognised at once the disease which I had first studied as a young pathologist in New York in 1903 and 1904. This disease is not new in Bermuda, although growers have not suffered from it for many years. One of the first investigations was made by Arthur Shipley (now Sir Arthur, I believe) in Bermuda in 1886 and 1887, at which time the disease was very destructive in your Islands, being so serious that an appeal was made to the British Government for this investigation. Although your former Director, Mr. E. J. Wortley, had often sought this disease in the onion fields, he reported to me that he had never seen it, nor had your present Director opportunity to become familiar with it. On the occasion of my first visit to Bermuda in 1919, I also looked for it in vain, only to discover that pink-root was the chief cause of your onion losses. Throughout the year I was with you I again sought for the onion blight, but never found it. The cause of this sudden epiphytotic appearance this year appears to be easily explained. I was told by many people in Bermuda that the winter of 1923 was one of the coldest and rainiest that you have experienced in many years. The onion blight is caused by a fungus **Peronospora Schleideniana,** closely related to the fungus **Phytophthora infestans,** causing the late blight of potatoes. In its weather relations it is much like the potato late blight fungus, as it is also in its structure and method of dissemination and infection. It is a fungus which thrives only in cool, moist, rainy or muggy weather, and is particularly favoured by cool nights with heavy dews. The conditions for this fungus during the current season appear to have been ideal, as is indicated not only by the almost complete destruction of your onion crop, but also by the destructive occurrence of the potato blight in your Garnet crop. Both fungi are favoured by the same sort of weather.

It is highly probable that this fungus occurs every year with you on an occasional onion plant in especially moist or favourable localities. During the past ten or fifteen years conditions have not been favourable to its destructive development, and so it has been easily overlooked or difficult to find, even when sought by an experienced plant pathologist.

The fungus passes the summer in the old dead onion leaves on the ground, or in bulbs that may be carried over from one season to the next. It may also be brought in with the seed. A single blighted spot early in the season in an old seed bed or in early onions would provide sufficient spores to infect all the onions throughout the Islands, if weather conditions were favourable. This was apparently the case this season.

It is the opinion of many people with whom I talked in Bermuda that as much as 75 per cent. of the onion crop had been destroyed. The attack came so late in the growing season that it is hardly possible that the onions can recover sufficiently to give the bulbs much size, and those, if any, which are produced, will probably be too late to be worth much in the market.

No successful method for the control of this disease has heretofore been known. Spraying has failed to control the disease in the past simply because it could not be made to stick to the onion leaves. There is every reason to believe, however, that the copper-lime dust will control the disease, if applied early enough, frequently enough and with sufficient thoroughness, because the dust will stick readily to the waxy surface of the onion leaves while the spray will not. I think I am safe in saying that had Bermuda onion growers anticipated the severe attack of the blight in February, they might have largely discounted the present loss by using dust. It is highly probable that this disease will appear next year. There are two reasons for expecting this. First, the very general abundance of the fungus throughout the Islands this season means that the spores of the fungus will be present in the soil in great abundance next fall. In the second place, it is reasonable to expect a series of springs in which the weather will be rainy and cool. For these reasons I would suggest that a campaign be put on next winter urging all growers to dust their onion crop beginning early in the season after the planted onions have become thoroughly established. The number of applications and the frequency with which they should be dusted will be determined by the weather. I should expect that not less than five applications from February until the middle of April will be necessary. If the weather be rainy and cool, twice as many applications may be required to hold the disease in perfect control. The dust to be used should be the same as for potatoes or celery without the poison. This copper-lime dust should be applied at the rate of two and one-half to three pounds per ten rods at each application. Dusting up one side of the bed and down the other with a third time over the middle of the bed so as to hit the onion leaves from all sides. The applications should be made late in the evening or early in the morning when the air is quiet. I feel sure that if Bermuda had had an alert plant pathologist this season he would have been able to have saved many times his salary on this disease alone.

Potato Blight.—In comparison with the season of 1922 my observations indicate that the Garnet crop of 1923 is much more seriously affected than I would have anticipated. Again it is a case of a very favourable season for this disease. I think it is a safe estimate to say that the late blight has reduced the crop of Garnet potatoes this year not less than 50 per cent. From what I have seen of potato yields in Bermuda, it seems to me that it ought to be possible for the Bermuda farmers to count on getting on the average not less than six to eight barrels for each barrel planted. Whereas the facts of the case are that he gets now an average of not more than four to one. This loss of 50 per cent. is to be accounted for largely in the injury caused by fire-worms, early blight and late blight. All of which, and especially fire-worms and late blight, are easily controlled by timely applications of insecticides and fungicides. I saw plenty of convincing evidence that even in seasons like the present, the late blight in Garnets may be fully controlled by spraying or dusting. The chief reason why Bermuda farmers generally suffer from blight is that they do not as a whole seriously attempt to control it. Even those who spray or dust most thoroughly do a relatively poor job of it. I feel sure that if the following schedule is carefully carried out no farmer need to fear losses of any account from the late blight.

Make the first application, whether dust or spray, before moulding the plants, repeat the application frequently throughout the season, not less than every ten days, preferably once or twice a week ; the more frequent applications to be made when the weather is rainy. Apply the spray or dust **just ahead** of the rains, and **not just after,** as is now the common practice with Bermuda farmers. This method of spraying just ahead of the rains is vital to the success of the undertaking. Most farmers cease spraying or dusting much too soon. It should be kept going right up to digging time. There is no reason I can see why farmers should not in an ordinary season always have thoroughly green plants when they dig the Garnet crop. This will not only increase the yield, but will largely cut out the losses from rot in the ground or during shipment. Healthy tops are bound to give healthy tubers.

Snapdragon Rust.—While snapdragons are of little economic importance to Bermuda, they do constitute a distinct asset to the Islands. They have been the most easily and successful grown of annuals, and have contributed their wonderful burst of colour to the beauty of the spring gardens. The general outbreak of the snapdragon rust caused by the fungus **Puccinia Antirrhini,** will serve as another striking example of how introduced fungi are able to demoralise the plants in Bermuda. During the spring of 1922 I was pretty well over the Islands from one end to the other. I visited many gardens where snapdragons were grown. Only in two places during that season did I see any traces of this rust, and then only on a few plants. I was convinced that this disease was only recently brought in and I predicted that in the next season, 1923, it would run riot over the Island. It proved to be an accurate prophecy. I have never seen a fungus so quickly spread throughout a country with such complete destruction after it is introduced as this one has done. There is no doubt in my mind that the fungus was brought in on potted plants or seedlings imported by some person for his garden. Probably only a few plants with the fungus on them came in, and these have served to start the disease. You can hardly hope to completely eradicate the pathogene and it will be difficult, if not impossible, to satisfactorily control by spraying or dusting. The fungus lives through the summer on old snapdragon plants or in volunteer plants in gardens that are abandoned for the summer, or where people do not take the trouble to destroy them after the main blossoming season is over. Thus you may expect this fungus to continue year after year, and only in isolated places and in seasons not especially favourable to the fungus may you hope to have fine snapdragons in Bermuda. Even under such conditions few of these plants will be grown, as people will be too discouraged in most cases with the results, and will gradually abandon the growing of this beautiful flower.

Nothing short of the following programme offers much hope that you may eradicate the fungus from Bermuda. Everyone on the Islands must co-operate with the Director of Agriculture, and completely destroy their snapdragons for one year, allowing none to grow. It is then highly probable that the fungus will die out and you can once more grow snapdragons successfully. I do not believe any regulations requiring people to do this will prove effective. I do believe, however, that an energetic campaign of education will

prove effective. This will require, however, the interested and active assistance of influential people of every class in all the parishes. It will require action as well as talk, and the keeping of the campaign constantly before the people.

Oleander Scale.—I was very much delighted with the oleander scale situation. There can be no more doubt at all that the people of Somerset Island have for the present at least saved their oleanders. Two thorough spraying campaigns have been carried out, as you know, and the results speak for themselves. I spent some hours searching the oleander trees in Somerset on 6th April. I gave particular attention to those hedges where the scale had been severe at the time of our first spraying, and I found no living scales, but I am told by some of the people of Somerset that there are a few infections here and there showing up this spring. If the people of the parish will again take up the fight and spray all infested hedges thoroughly, there is in my opinion no reason to doubt that for another year the oleander will be safe there. I am frank to say that the Somerset people are the only ones while I was there who took an active personal interest in the fight against the pest, that is as a community, and they have certainly been rewarded for their interest in this direction. In striking contrast is the St. Georges end of the Island. There only one general spraying campaign was carried out, and it received very little active support from the people, except in the case of a very few. Rev. F. M. Brunton is deserving the highest praise for the personal interests, efforts, and labours he devoted to the campaign. The scale is rampant at the eastern end of the Island. Many hedges have died or nearly so, and further destruction of the oleander may be expected this season.

While the spray is undoubtedly a success, there is an encouraging prospect in the direction of the spread of the parasitic fly, which was first introduced last year in Paget and thereabouts. The Director of Agriculture has imported additional material since I was there. He has found the parasite spreading from the original plantings, and I was astonished to find that the scale has been completely destroyed about Knutsford in Paget on the flopper or life plant where I had first introduced it. I had also put some of the first shipments of the parasite in two large oleander clumps in an isolated place on the Station grounds. When I left these two clumps were badly infected with the scale. These have never been sprayed as they were left for breeding the parasite. Examining them the other day I failed to find a live scale. Examining the scales they showed little holes in the top where the parasite had flown away to attack other scales. These two clumps are rapidly recovering. It seems to be repeating in Bermuda its beneficial record in other countries such as Italy, Southern United States, France and Argentina, where it has completely brought this scale under control. Nevertheless, I should not expect this parasite to completely get the upperhand of the scale in less than three or four years, so that in the meantime persons wishing to preserve their oleander hedges will have to depend on spraying. The people of Bermuda should now collect the scaled floppers and oleanders from the clumps where the parasite is known to be active and spread them widely over the Island, thus assisting in the dispersal of the parasite, and hastening the day when spraying will no longer be necessary.

The Director of Agriculture should not be expected to do this, but the people of the Island themselves should make it their business to carry on this work. The Director of Agriculture knows the localities where the parasite has been planted and can assist persons in getting parasitised material. In the recent shipments which he has received from Italy are other parasites which prey upon this scale, and these when they become established will assist the parasitic fly in fighting the oleander scale. On the whole it seems to me that the fight against the oleander scale has been far more successful than we had any reason to expect when the battle was joined. This ought to give the people of Bermuda increasing confidence in the possibility of meeting their pest problems in the future, and show them the value of scientific methods in work of this kind.

Celery Blight.—My observations indicate that celery blight is less abundant this season than last, or is later in making its appearance. It is, however, present in many fields, and undoubtedly will cause heavy loss before the season is over. The general and thorough application of copper-lime dust will control this trouble. My only fear is that most growers have been late in starting their dusting this season. Celery blight, like late blight of potatoes, can not be satisfactorily controlled if spraying or dusting is delayed until after the blight has appeared. It must be made a regular part of the annual farm practice, and be started early after the plants have been set out in the field. The use of plants from diseased seed beds is likely to mean the loss of a crop, and should be carefully avoided.

Onion Pink-Root.—The cool moist weather of this current spring has been very unfavourable to pink-root, and it has evidently caused but little damage, but an examination of the onions shows the fungus is still present in the field, and whenever the season is favourable heavy injury from this fungus may be expected. The methods recommended for its control last year, namely, of seed-bed treatment and the use of nitrate of soda in the field, should not be forgotten and should be regularly employed in the future.

Dusting.—Dusting has been adopted by the Bermuda farmers more promptly and more generally than I had any reason to expect when I left last June. The evidences that I could gather indicate that when I left Bermuda in 1922 not more than five hundred to one thousand pounds of dust had been used by Bermuda farmers, while on my return on April 4th ten tons of dust had been used up to that time. I think it safe to predict that the amount will double or treble next year. This is a wonderful record in progress for farmers, naturally conservative and slow to adopt new methods. It proves to my satisfaction that all that is needed in Bermuda is a good plant pathologist on the job throughout the year to work with the farmers ; to show them how to adopt modern methods and to get them into the practice of using them. I feel sure that if your Department of Agriculture had had a good plant pathologist this winter, you would have had the satisfaction of seeing relatively little loss from potato blight. The Director of Agriculture is too heavily loaded with administrative matters to give his time in any considerable amount to plant disease work, and no blame for the failure of crops by diseases and pests can be laid at his door. Only with a well-trained and enthusiastic pathologist can you hope to meet this most important of Bermuda's agricultural problems.

AGRICULTURAL EDUCATION.

During my year in Bermuda I was constantly impressed with the fundamental needs of Bermuda's agriculture, namely, an agricultural education for the rising generation. While it is not my function to raise this question with you, gentlemen, I cannot let pass the opportunity to say a word for the coming generation of farmers in Bermuda. Twenty years in the State of New York has demonstrated to me, not only the fundamental necessity for agricultural education, but the effective importance of it in a sound and prosperous agriculture. It bears a vital relation to the adoption of scientific methods of plant disease control, and for this reason, if for no other, it deserves the consideration of the plant pathologist.

It must be evident to every thinking Bermudian that the future agriculture of the Island will be largely in the hands of its Portuguese citizens. The Portuguese constitute an overwhelming majority of the farming people of Bermuda, and Bermuda agriculture in the future will be successful just to the extent to which the Portuguese farmers are able to prosper. They take naturally to the land, and have the native ability to succeed as farmers. Like all other agricultural peoples, however, they cannot hope to meet modern conditions with ancient methods. Successful farming is no longer merely a matter of muscle. It is more than ever a matter of brains, trained brains as well as trained hands. So far as I can see, however, nothing is being done to train the future farmers of Bermuda in their profession. Unless active steps are promptly taken to provide agriculture education for farm boys, the Portuguese boys will, like their predecessors on the land, turn to the city for employment, and ten years from now the agricultural labour problem will be worse than it is at present. The days of farming with ignorant labour directed by a few intelligent overseers or land owners in Bermuda as well as in other countries are going. The only really successfu farmers in Bermuda to-day are those who actually farm the lands with their own hands, and with their heads as well. Any intelligent industrious and educated man of ordinary ability can not only make a good living, but also a small fortune, in farming in Bermuda. Whatever the conditions of marketing, transportation or financing, these are not the fundamental factors even now. This is proven by the fact that even under the present deplorable conditions there are a number of the individual farmers making money and prospering in your Islands.

I, therefore, beg you to consider fully for your future welfare the desirability of establishing in Bermuda a thoroughly modern up-to-date agricultural school for farm boys or city boys who wish to go back to the farm. This school should be started on a small scale with future plans for additions and developments as the demand grows. The school should be centrally located, should be provided with a reasonable amount of agricultural land, say ten or twelve acres, with additional buildings for laboratories or work shops, with adequate buildings to house the instructors, stock and even, perhaps, dormitories for the boys who live at too great a distance to come from home daily. I should think two good teachers would be sufficient in the beginning. These should be young men trained in a modern agricultural college with high ideals and an earnest desire to train these boys, not only to make money, but to live a happy and prosperous life on Bermuda farms.

The boys should come to this school in my opinion when they are eight or nine years old and spend from four to five years. The main sessions of the school should be held through the summer months when the demand for these boys on the farm is least urgent. During the winter months they may attend the school part time, say certain days in the week. The teachers should devote part of their time in the winter to teaching these boys on their own farms, conducting agricultural clubs, competitions, etc. Special textbooks should be prepared by these teachers in the form of mimeographed outlines, dealing with agricultural matters as they pertain to Bermuda conditions. Reading, writing, arithmetic, geography, accounting, and all other subjects to be taught should be based on agriculture and in particular upon Bermuda agriculture. The most worthy boys in the school should each year be given a short trip to the States or Canada as a reward for their interest in their work, going with their teacher to some good truck crop region so they can see and study the methods employed elsewhere. No more profitable investment could be made by the Bermuda Government.

When it becomes as **honourable and profitable** to be dirt farmers in Bermuda as it is to be clerks, merchants, lawyers, doctors and politicians then and only then will the problem of agriculture be well on its way to solution. I ask that you, gentlemen, give this your most careful and earnest contemplation. It is thus that the problem of agriculture the world over is being solved, and Bermuda must sooner or later take this step, for without a successful agriculture, Bermuda cannot hope to maintain its happy and prosperous national life. When agriculture dies in Bermuda the tourist trade will fade away, for after all, the great bulk of tourists come to Bermuda in increasing numbers to see a land of gardens, flowers and farms. They come in the winter to Bermuda, for it is like a garden of Eden to them, and when thorns and weeds possess your fields and your buildings begin to decay and tumble down for want of the husbandmen, then will your tourists go elsewhere, for there are many other sunny lands but little farther away than are the Islands of Bermuda.

IN CONCLUSION.

I trust that my recent short stay with you has been of some value to Bermuda, and that this brief report which I have the honour to submit to you may be found worthy at least of your casual consideration. I am not submitting it in the expectation that you will accept my finding even in every part, and I shall not be disappointed, but I shall be delighted if I have even in a small degree drawn your attention effectively to what seems to me some of the future problems of your wonderful country.

Respectfully submitted,

H. H. WHETZEL,

Professor of Plant Pathology.

New York State College of Agriculture,
Cornell University,
Ithaca, New York.
April 17th, 1923.

Abstracts from Mr. K. H. Fernow's Report on Triumph Potatoes.

The writer spent the week of November 19th to 26th in Bermuda inspecting potato fields. The purpose of this visit was to investigate the cause and extent of a severe outbreak of leaf-roll in Long Island grown seed. The writer is much indebted to Mr. E. A. McCallan, Director of Agriculture, for his courteous assistance in the matter of transportation, tracing of stock and many of the disease counts reported here. Some of the counts were also made by Mr. Ogilvie, the Colonial Plant Pathologist and Inspector Winter. In some cases the counts were made by Mr. McCallan before the arrival of the writer.

Possible Causes of High Percentages.—Even the best of the Long Island seed represented is in bad shape. It is generally considered in Bermuda that to be satisfactory, seed should contain not more than 5 per cent. leaf-roll. However, seed of high vigour which contains as high as 10 per cent. will please the grower better and probably give a better yield than slower germinating, less vigorous seed which contains little or no leaf-roll.

It is impossible to state with any degree of assurance the cause of the high percentage this year. Various individuals have advanced theories of which the following may be mentioned.

(1) Seed was already infected in 1922 but was masked in 1923 so as to escape detection in the 1923 inspections.

(2) Bermuda conditions cause plants to show leaf-roll which does not show under New York conditions.

(3) Seed from other sources than the Long Island fields inspected was introduced through the dishonesty of grower or shipper.

(4) A heavy spread took place in the 1923 fields due to aphids or other insects which carried the disease from other fields or from centres of infection within the field.

With respect to (1) it may be pointed out that seed from the 1922 Batavia stock grown in Bermuda instead of Long Island and now in the second generation in Bermuda showed little leaf-roll in the first Bermuda generation and only about 4 per cent. now when in the second. This same fact obviates the possibility of the leaf-roll being merely a function of the Bermuda conditions. Furthermore, New Brunswick-Bermuda seed now growing in Bermuda for the second time was observed to be relatively free from leaf-roll.

With respect to the question of dishonesty it can only be said that there is no provision of the Bermuda importers which would prevent the shipping of uninspected stock as inspected stock. However, there is no proof that this was done in any case.

That a heavy spread of leaf-roll may have taken place due to aphids bringing in the disease from other fields is not impossible. The Long Island fields are said to have been fairly well isolated. Still it may be that under some conditions aphids or other insects may carry the disease some distance. Schultz and Folsom (Degeneration Diseases of Irish Potatoes, Jour. Agr. Res. 25; 43-117, pls. 15, 1923) give data in Table 28, page 108, which seem to indicate a transmission of mosaic in considerable amounts to a distance of 100 metres.

As to infection from centres in the fields, the following facts are worthy of note. The stock planted on Long Island, both that planted for the Hickox-Rumsey Co. and that for Henry Zimmer and Son were inspected by Mr. McCallan. The fields were reported to contain 0 to about 2 per cent., most of the fields showing about 1 per cent. Since all the stock was the same, it is probable that all the fields were about equally infected to start with, apparent differences being due to masking or to the small number of counts made. The Hickox-Rumsey fields were rogued immediately after inspection while the others were not. No doubt even after thorough rogueing a few leaf-roll plants would still remain in the field. These would either be old cases which were concealed by overshadowing healthy plants or recent infections which had not yet showed any symptoms. The spread may have taken place in one of three ways: before rogueing, after rogueing, or continuously. If the spread had taken place entirely before rogueing we would expect the rogued fields to show practically as high a percentage as the unrogued fields. But if any considerable spread had taken place after the rogueing was done we would expect a higher percentage in the unrogued potatoes, which is what we find. The rather considerable percentage present in the rogued stock may represent spread which took place before the rogueing or spread which occurred after rogueing from the few infected centres which were overlooked. The large difference between the rogued and unrogued stock would seem to indicate that most of the spread took place after rogueing.

Recommendations for the Future.—It is felt that the Bermuda Government or importers should take steps to prevent the possibility of fraud. No honest grower or dealer can have any objection to this. In fact, such a procedure would be a safeguard to the producer's reputation in the case of breakdown of stock.

It is felt that Long Island is a hazardous locality in which to grow seed potatoes. In some seasons good seed can be obtained there, but the chances of failure are considerable. Experiments to find a more desirable locality should be continued. It appears that the Batavia crop was two to three weeks too late in maturing to give satisfaction. Unless the crop can be regularly depended upon to mature two weeks earlier than in 1923 it is useless to consider this locality as a seed source for the fall planted crop.

Since it will take several years to find a more satisfactory locality, if there is one, it will be necessary in the meantime to grow the bulk of the seed required on Long Island. In view of the failure this year it is felt that the following precautions should be taken :

(1) Test in Bermuda during the winter possible sources of seed for Long Island planting.

(2) Plant on Long Island only the best stock obtainable, in no case seed containing more than 2 or 3 per cent.

(3) Plant in large fields as well isolated as possible.

(4) Rogue all Long Island fields at the earliest possible date. A second rogueing is advisable.

(5) Use sprays or dusts to control insects.

K. H. FERNOW.

New York State College of Agriculture,
Cornell University,
Ithaca, New York.
December 1st, 1923.

Appendix A.

(1). Comparison of Retail Prices of Farm Supplies and Services 1913 and 1923.

	1913.	1923.
Rent, estimated increase	—	10%
Labour, per day	4/– to 5/–	8/– to 10/–
Seed, Potato—Triumph, barrel	19/–	33/–
,, Garnet, ,, ...	13/–	26/6
Onion, lb.	8/–	10/–
Beet, lb.	3/6	5/–
Carrot, lb.	3/6	5/–
Parsley, lb.	3/–	6/–
Fertiliser, Castor, Pomace, English, 100 lbs.	5/3	10/–
,, ,, American, ,, ...	6/–	12/–
Horse manure, cart load	4/–	8/–
Spraying material, Lime, bushel	10d.	1/9
Blue Stone, lb.	4d.	10d.
Pyrox, 100 lbs.	55/–	120/–
Containers, Barrels, each	1/6	4/–
Crates, bushel, Canadian, each	6d.	1/6
,, ,, American, each	5½d.	1/6
,, celery, each	10d.	1/9
Nails, 100 lbs.	13/–	33/–
Shipping charges, Shed tax, barrel	1d.	1d.
,, ,, crate	½d.	½d.
Freight to New York, potatoes, barrel	50 cents.	90 cents.
Freight to New York, onions, crate ...	14 ,,	20 ,,
Freight to New York, roots, crate ...	25 ,,	25 ,,
Freight to New York, top crops, crate	25 ,,	30 ,,
Freight to New York, celery, crate (2 bu.)	60 ,,	70 ,,
Cartage in New York, barrel	7 ,,	25 ,,
,, ,, crate	4 ,,	10 ,,
United States import duties, potatoes	free	½ cent. lb.
carrots	15%	25%
potatoes	8%	10%
onions and other vegetables	10%	10%

(2) COMPARISON OF AVERAGE NEW YORK PRICES, 1913—1923.

	1913.	1923.
Beets, bushel crate	97½ cents.	$1.89
Carrots, bushel crate	95 ,,	1.83
Celery, 3 bushel crate	$5.10	(2 bus.) 6.66
Lettuce, bushel crate	1.34½	1.34
Onions, bushel crate	1.53	3.04
Parsley, bushel crate	1.07	1.88
Potatoes, barrel	5.97	12.97

The **quantities** sold at varying prices were not considered when the above average prices were computed.

(3) ESTIMATED COST OF PRODUCTION AND MARKETING IN 1923.

Beets, bushel crate	$1.87
Carrots, bushel crate	1.68
Celery, standard crate	6.30
Lettuce, bushel crate	1.47
Onions, bushel crate	2.06 (cost of a normal crop).
Parsley, bushel crate	1.68
Potatoes, barrel	9.77

The estimated costs given above include production, containers, wharfage, freight, cartage, duty and commission.

Appendix B.

Return made by the Government Veterinary Officer of Live Stock Imported during the year 1923.

Horses	286
Cattle	29
Pigs	154
Dogs	101
Poultry	563
Total	1,133

Brightside, Flatts,
28th May, 1924.

Appendix C.

Expenditure (Exclusive of Salaries) for the year ended 31st December, 1923.

1. PAYMENT OF MEMBERS OF BOARD.

	£	s.	d.	£	s.	d.
Appropriated by Appropriation Act, 1922		—		80	0	0
Paid to Members for attendance	45	12	0		—	
Unexpended balance	34	8	0		—	
	£80	0	0	£80	0	0

2. GENERAL GRANT.

	£	s.	d.	£	s.	d.
Appropriated by Appropriation Act, 1922	2,200	0	0			
Appropriated by Resolve No. 15 of 1923	150	0	0			
				2,350	0	0
Field labour on experimental plots, lawns, flower beds and glasshouses, and for care of dairy stock	1,146	0	11			
Carting and ploughing	85	6	2			
Manure and fertilisers	70	16	3			
Seed potatoes, seeds, bulbs and plants	103	11	1			
Empty barrels and box shucks	12	16	6			
Live stock—feed, bedding and incidentals ...	343	13	4			
Repairs and renewals of tools, implements, etc.	273	16	6			
Electric light and power	3	11	0			
Periodicals	7	6	7			
Postage, stationery and printing	119	16	9			
Agricultural Clubs, prizes to	8	15	0			
Cleaning offices	14	5	0			
Sundry expenses	3	1	5			
Unexpended balance	157	3	6			
	£2,350	0	0	£2,350	0	0

3. INSPECTION SERVICES, MARKET INVESTIGATIONS AND CONTINGENCIES.

	£	s.	d.	£	s.	d.
Appropriated by Appropriation Act, 1922		—		1,250	0	0
Inspection at dock	468	4	0			
Inspection of seed potatoes in Canada and the United States	113	2	10			
Representative at New York Market	178	15	6			
Representation made by Director in New York regarding reduction in freight rates, and in Washington regarding plant quarantines, etc.	44	8	9			
Advertising in Canadian papers	36	12	6			
Equipment for and supervision of Farmers' Market	75	1	8			
Cables	33	18	1			
Supplies and contingencies	70	15	1			
Unexpended balance	129	1	7			
	£1,250	0	0	£1,250	0	0

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4. ERADICATION OF ANIMAL DISEASES.

	£	s.	d.	£	s.	d.
Appropriated by Appropriation Act, 1922		—		100	0	0
Compensation to owners of condemned stock ...	14	0	0			
Supplies	57	0	8			
Unexpended balance	28	19	4			
	£100	0	0	£100	0	0

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5. DEPARTMENTAL CONTINGENCIES, TRAVELLING EXPENSES OF OFFICERS OF DEPARTMENT, TELEPHONES.

	£	s.	d.	£	s.	d.
Appropriated by Appropriation Act, 1922		—		220	0	0
Passage from England of Plant Pathologist ...	39	10	0			
Printing Annual Reports, 1922	32	7	1			
Carriage hire	34	10	0			
Telephones	6	10	0			
Electric light and power	3	14	1			
Supplies and contingencies	73	0	7			
Unexpended balance	30	8	3			
	£220	0	0	£220	0	0

6. ANNUAL EXHIBITION.

	£ s. d.	£ s. d.
Appropriated by Appropriation Act, 1922	—	200 0 0
Labour, material and contingencies	200 0 0	—
	£200 0 0	£200 0 0

7. PURPOSES OF PLANT AND BULB DISEASES AND PESTS ACT.

	£ s. d.	£ s. d.
Appropriated by Appropriation Act, 1922	—	350 0 0
Labour	89 6 0	
Insecticides	142 18 7	
Expenses of Prof. H. H. Whetzel's visit to Bermuda	24 8 6	
Equipment and contingencies	91 9 1	
Unexpended balance	1 17 10	
	£350 0 0	£350 0 0

8. PURCHASE OF SCIENTIFIC APPARATUS AND BOOKS.

	£ s. d.	£ s. d.
Appropriated by Act No. 4 of 1923	50 0 0	
Appropriated by Resolve No. 15 of 1923	50 0 0	
		100 0 0
Apparatus, books and contingencies	99 10 10	
Unexpended balance	9 2	
	£100 0 0	£100 0 0

9. RESOLVE NO. 1 OF 1923.

	£ s. d.	£ s. d.
Appropriated by Resolve No. 1 of 1923	—	3 0 6
Cables received from New York during December, 1922	3 0 6	—
	£3 0 6	£3 0 6

Appendix D.

Statement of Reimbursements to Government and Produce supplied to other Government Institutions during the year ended 31st December, 1923.

REIMBURSEMENTS TO GOVERNMENT.

	£	s.	d.
Sales of potatoes, vegetables, plants, etc.	29	13	11
Sale of animals	20	0	0
Registration fees from Seedsmen	3	15	0
Live stock fees	19	12	0
	£73	0	11

PRODUCE SUPPLIED TO OTHER GOVERNMENT INSTITUTIONS.

	£	s.	d.
Potatoes, King Edward VII. Memorial Hospital	24	0	0
Potatoes, Hamilton Gaol	24	0	0
Potatoes, Lunatic Asylum	18	0	0
Other vegetables, King Edward VII. Memorial Hospital (estimated)	15	0	0
Milk, King Edward VII. Memorial Hospital	129	6	0
	£210	6	0